Canard Pushers from 1 to 82

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Notes on "THE ELECTRONIC CP", by Stet Elliott

"THE ELECTRONIC CP" is a set of computer files consisting of all Canard Pusher (CP) Newsletters published by Rutan Aircraft Factory. The set includes all CPs from the first one published in May 1974, to number 82 published in October 1995. There have been newsletters published after that date, however I do not intend to convert them to digital format.

Every effort has been made to ensure accuracy in this product set, but ACCURACY IS NOT GUARANTEED! If you are building a Rutan design, you MUST NOT rely on "THE ELECTRONIC CP" as your only source of current information. You will also need the printed copies of the CP's because "THE ELECTRONIC CP" does not contain the required illustrations, photos or graphs you will need to properly build and fly a RAF design. Obtain printed copies of Canard Pusher newsletters from Rutan Aircraft Factory, or another builder. You may make copies of another builder's CP's. This is approved and encouraged by RAF, and is so stated in each recent newsletter.

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ADDITIONAL NOTES ADDED 08/09/2002

The document assembled by Stet Elliott was formatted in WORD and converted to an HTML file which can be searched for specific words of the readers choice. The formatting and conversion was done by

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VARIVIGGEN NEWS NO. 1 May 74

RUTAN AIRCRAFT FACTORY/P.O. BOX 111/VALLEY CENTER, KS. 67147

THE NEWSLETTER staff has finally organized: Burt Rutan, Editor-in-Chief; Carolyn Rutan, Proof Reader. This, being the first newsletter, will be mailed to all holders of VariViggen Tech. Reports and Plans. Future newsletters will be mailed only to those who actually plan to build an airplane and who have an Aircraft Serial Number assigned.

This is your newsletter, the sole purpose of which is to aid in your construction projects through exchange of information. Please feel free to send progress reports, comments, or photos of your project for printing in future newsletters.

ACTIVITY at the RAF - Carolyn and I have spent a busy Fall and Winter preparing the plans and getting them mailed. My apologies to those who waited several months. Our prototype, N27VV, has passed her 300th flight-hour, and our latest inspection and relicense revealed only that she needed new tires and brake pads. The low maintenance requirements have been very pleasing. Check around and see how much flying most homebuilt prototypes see in their first two years! We took several trips this winter - see May '74 "Sport Aviation". N27VV has given two airshow performances so far this year and we have approximately eight more on the schedule for this season, including Oshkosh, July 31-August 6, and Brantford, Ontario, August 10 and 11. Sales of plans now total 190, and 53 builders have already returned their "Page Two", requesting a serial number and indicating that they plan to build an airplane. Of these, 41, plan to build theirs similar to the prototype or with minor modifications, and the rest - wow! We will see some very interesting flying machines! To get on the Sport Aviation list of Aircraft Under Construction, I urge you to notify EAA Headquarters of your project. To the builders, I'm enclosing a complete list of all present builders (by Aircraft Serial Number), their addresses, and any major modifications they are considering. I will mail the list to other plan holders only if they return "Page Two" indicating they intent to build an airplane. This list will be updated each Newsletter.

PLANS Changes - I'm very happy to report that there have been very few corrections reported.

1. Material was omitted on F13; it is 1/8" plywood.

2. The fixed trim tabs, which are discussed in the Tech Report, were omitted. They should be installed on each elevator to improve trim characteristics (speed stability). Each tab consists of a Balsa wood airfoil epoxied to two booms (1/4" hardwood dowels) which are epoxied into 1/4" slots notched into the trailing edge of the elevator. I have noted no performance loss due to the tabs. The booms increase the tabs effectiveness at high speed and prevent the tab from reducing maximum elevator lift. **SKETCHES OMITTED**

3. The Tech Report refers to the propeller size as 70Dx67P. Performance on 150 HP is best with a 69Dx64P or 69Dx65P prop as shown in the plans.

4. Zounds!$#, don't plug in your angle-of-attack indicator! I slipped a decimal point on a resistance (pg 43 of Plans). The revised schematic shown, also includes the trimpots I have in my airplane to allow fine calibration. This is identical to the system in N27VV. This system can also be used for the car-top wind tunnel shown in the Tech Report. **SKETCH OMITTED**

5. The sharp eye will note the slant in the side of F121 bulkhead on pg 19 (B.L. 12.1 to B.L. 12.25). This is because the bulkhead slants backwards (see side-view) while the fuselage is getting more narrow (see top-view). No errors here; just a clarification of the reason for the slant.

6. NG35 is an 8" Scott tailwheel assembly, not 9".

VVN1, Page 2

ALTERNATE Source for Epoxy - I've found another wood bonding epoxy that can be substituted for the Epibond. It's a 50-50 mix and, thus, is less critical to mix than the 10-to-1 Epibond. It's Bond Master M666 by National Starch & Chemical Co., 653rd Ave., N.Y., N.Y. Weibe Wood Products, 311 S. Kansas, Newton, Ks., 67114, sells it at $13. for two quarts. I've seen its excellent results in several wood aircraft.

ENGINE Selection - Alot of you indicate preference for larger engines. Frankly, I'd like to have an 180 hp O360 in mine, but I do not recommend the 200 hp Lycoming: the extra weight would create a tailheavy condition that would require some redesign. The same is true for a metal prop or constant speed prop. As many are now finding in other applications, the modern wood prop is unbeatable for fatigue-free safety.

FULL-SIZE Drawings - I received a question as to why all the drawings for ribs, etc. are not full-size to allow tracing to the part. The answer is because so many of the ribs, etc., are so long, that they won't fit any convenient paper size, and that paper that long, can shrink and thus effect the size of the part. If you use the following hints you will find that converting the scaled-down drawings will be a very small percentage of the work required to build your aircraft:

Do not draw the part full size to transfer to the material; transfer the dimensions directly to the wood or metal (ball-point pen on wood; BIC Banana on metal). Have a wife or friend read the dimensions from the drawing or grid while you use a scale to plot them on the material. This is much faster than looking back and forth and eliminates errors. Buy a Stanley metal tape, rule no. B61-112Y. This is a 12 foot retractable tape-rule with graduations in tenths of inches, not 1/16ths. That tool alone will save you many hours of conversions.

MACHINED Parts - A question has come up as to whether the machined parts will be available. If I can receive orders for 25 or more sets,

the handling and shipping costs can be justified. The set would include

(8) WA5 taper pins	(1) NG32, NG33, NG34 assembly (welded, heat-treated & chromed)
(1) RM5 screwjack	
(1) RM6 threaded tube	
(2) V1 plugs	(1) NG37
(1) NG1 spool	(2) MG12
(1) NG28	(2) MG15
(1) NG29	(2) MG19
(1) NG30	(2) MG30
(1) NG31	(2) MG35
	(1) MG42

Let me know if you would consider buying some or all of these. The price would be more than it would cost if you had a good friend with a lathe, but considerably less than if you took the drawing to the local machine shop. I'll definitely have F23, F25, F27 and F28 available by December 1974 and the cowling shortly thereafter.

PHOTOS - I'm also considering making available photographs, if there is demand enough to get a low price. Let me know if you would be interested in

Set #1 8x10 Color - Top quality, suitable for framing:
1 inflight shot
1 ground shot with Carolyn
1 shot showing cockpits with canopies open.
Approximate cost, $14. plus mailing cost.

Set #2 4x5 Black & White glossy:
4 different inflight shots
4 different ground detail shots
4 different cockpit shots
Approximate cost, $5. plus mailing cost

VARIVIGGEN PATCH - The symbol on the cover, we selected as the official VariViggen patch. Our distinctive plan view identifies us without need for words! Look for it at Oshkosh. Sew-on jacket patches will be available.

ITEMS - for Future Newsletters: Cockpit head system, stowable ladder I use for front seat entry, improved carb heat muff design, complete treatment process for sealing plywood and for exterior finishing, additional hints on electrical system, etc., etc.

QUESTIONS - I can answer your questions, etc., promptly only if you include a self-addressed, stamped envelope.

ORDER BLANK FOR MACHINED PARTS OMITTED

VARIVIGGEN NEWS NO. 2 Oct 74

Published quarterly by Rutan Aircraft Factory
Burt & Carolyn Rutan
Building #13, Mojave Airport
P.O. Box 656, Mojave, CA 93501

ACTIVITY at the RAF - This is the first opportunity we've had to inform everyone of our move. We have a new facility at the Mojave, California Airport where we are supporting VariViggen builders. We left Kansas in June and spent most of July in southern California looking for a home for the RAF. We then took N27VV on a 4500-mile trip which included the Oshkosh EAA convention (N27VV participated in the evening airshow and won the "OUTSTANDING NEW DESIGN" trophy this year), a visit with Ken and Margaret Ashdown (VariViggen builder S/N 069) on the beautiful island of Manitoulin in Ontario, Canada, Airshow appearances at Brantford, Ontario where we were the guests of the fine people of EAA chapter 115, stops in Kentucky, Indiana, Missouri, Kansas, and finally our big move to California, arriving in Mojave the first week in September. N27VV performed well despite the 110-lb baggage load on most of the trip and the 10,500-ft density altitude takeoff at Flagstaff, Arizona!

We made up "VariViggen Builder" badges for those who were at Oshkosh. We were pleased to see more than 40 builders during the week as well as six more at the Brantford show. Back-seat riders at Oshkosh included Fred Weick (Eurcoupe designer), Charlie Schuck (FAA), Harold Best-Devereux (EAA, Europe), Sheldon Gallager (Editor, Popular Mechanics), Peter Lert (Air Progress) and many of the builders. We flew two photo flights in which we posed for air-to-air shots in formation with Dick Curtis's Curtis Pusher Replica at 50 kt! Those photos should show up in magazines and the EAA film.

Even though the VariViggen had been to California twice before, we couldn't wait after arriving to Mojave for the first chance to really demonstrate her flying ability to the multitudes out West. The next weekend, September 7-8, was the EAA Western Fly-in at Porterville, CA. The following excerpt from the Bakersfield, EAA Chapter 71, newsletter written by Denny McGlothlen tells it all.

"The star of the show was Burt Rutan with his "VariViggen", Boy this bird really turned me on. I was out on the runway when Burt flew in the airshow, and seeing the VariViggen make the low speed sharp turns right at lift off, well an airplane just isn't supposed to do such things but this one sure will. I can see that this is going to be a very much built airplane in the EAA ranks."

The VariViggen succeeded in awing the crowd there and also won the "Most Popular" trophy, the "2nd Monoplane" trophy, and the 1st place cash prize for the spot landing contest. The VariViggen has won every spot landing contest it has entered. Due to the fantastic low speed maneuverability and visibility you can use quick tight turns on short final to set up the correct height and speed for the accurate touchdown. The 2nd place-winner at the Beatrice, Nebraska contest just shook his head and said, "That's no fair; That's not an airplane!"

We have two more airshows and a magazine article commitment within the next two weeks. After that we plan to remove the old cowling, give the aircraft a good inspection (she now has 400 flight hours) and install the new design cowling with prop extension. When testing is complete on the cowling we will begin cowling production.

RAF BUSINESS - Yes, we are now conducting a full-time business primarily to support VariViggen builders. Our facility on the Mojave Airport (100 yards S.E. of tower building) consists of an office and shop sufficient to allow us to provide VariViggen components, related engineering support for VariViggen builders, technical and educational material (the car-top wind tunnel project is aimed primarily at high schools and colleges), and engineering analysis/test consulting. Refer to the first edition of our CATALOG, included with this newsletter for detailed description of all products. The last page will be revised periodically and mailed to all builders.

We now see an important need for a periodic newsletter, complete enough to give all the information to builders that can assist them in their projects. Future newsletters will include essentially the same format information and photos as this one, with more builder-submitted information as it becomes available. All suggestions are considered - Remember this is your newsletter. Due to the fact that the plans have (and will be) marketed at a relatively low cost, builders are now being asked to share the continuing cost of research writing, setup, printing, and mailing the future newsletters on a yearly subscription basis. Refer to the CATALOG for the cost and publish dates. Newsletter #2 is provided free to all plans and TR holders. Future ones can only be sent to paid up subscribers. We will continue to provide the updated list of VariViggen builders only to those who have returned their plans "page two" and have received an Aircraft Serial Number. We keep individual correspondence files of builders with S/N's, which now totals 128 builders.

PLANS Changes - It has been four months since the last newsletter and many of the builders are well into their construction projects, so we have quite a few corrections/improvements to note. This section will provide changes, not only to the plans, but to the Tech Report and Owner's Manual as well. Changes will be classified as follows:

- MEO - Minor error or Omission.
- OPT - Optional Improvement.
- DES - Desirous Change - Does not necessarily effect flight safety but should be incorporated to improve the aircraft or correct a fault.
- MAN - Mandatory Change - Change must be incorporated as soon as possible as safety of flight is affected.

Remember, all mandatory changes are Air Mailed immediately to all newsletter subscribers.

CATEGORY	LOCATION	CHANGE
MEO	PL pg 59	Part No. of 8" Scott tail wheel assy omitted. NG35 is Scott #3200. Channel shaped plate is furnished

		with V-NGSA assy purchased from RAF.
DES	PL pg 1&2	Change RAF address: Box 656, Mojave, Ca. 93501
DES	PL pg 3	On weight & bal chart change 115 hp to 125 hp.
MEO	PL pg 5	Change number of AN3-14A bolts from 3 to 8. Change AN115-16 (16) to AN115-3 (3).
MEO	PL pg 11	3rd column, 2/3 down F.S.137 should be F.S.37.
DES	PL pg 13	I'm told that solid rod gives better antennae performance than tubes. Use 1/8" alum welding rod or some alum clothes line available at any dept. store.
MEO	PL pg 14	Clarification - The C12 belcrank bearing rivets to outboard side of C9.
MEO	PG pg 20	F30 & F29 identification is reversed on flat layouts.
MEO	PL pg 21	Capstrip detail W.L. 0.1 should be W.L. 0.0.
MEO	PL pg 25	SPAR F change WS3 to W3. Two places.
MEO	PL pg 26	SECTION L-L change 57 deg to 54 deg.
MEO	PL pg 27	Right center. Change 83 deg to 173 deg.
MEO	PL pg 31	WA3 Omitted dimensions. Left two holes are centered. Other six holes evenly spaced & 0.31" from edges as shown.
MEO	PL pg 36	Tolerance on all control travel is +- 3 deg, except reflex travel which is 0 to 1 deg up (when down) and 7 to 8 deg up (when up).
MEO	PL pg 37	EC1 can be made easier & stronger with the legs overlapped or with doubler plates rather than butt welded.
DES	PL pg 42	RM5 change coarse thd to course double advance thd (for faster reflex travel).
MEO	PL pg 45	Pivot detail F14 should be F31.
MEO	PL pg 46	NG32 change to .063 wall to .065 wall. NG1 1/16" hole for cable. Change to #50 drill hole.
MEO	PL CH 8,10	Clarification on wing attach assemblies. Be careful when cutting tapers in steel straps for WA5. There is a lefthand & righthand part to put the 5/16" holes in lower WA2 fittings on top.
DES	PL pg 50	MG2 5.1R should be 2.6R. MG5 1.63D should be 1.75D. MG11 1.7D should be 1.75D. MG4 "to fit MG12." The preferred method is to first drill MG4, clamp to MG12 then use MG4 as a drill guide to drill MG12.
MEO	PL pg 51	MG42 add the #50 drill cable hole as in NG1.
DES	PL pg 46	Strut assy. To allow improved strut lubrication, eliminate upper O-ring (2.8" from housing bottom) and move lower O-ring down .4" to within 0.1" of scraper. If you have already cut the two O-ring grooves, that's Ok; just cut the new lower one and leave the other grooves empty.
MEO	PL pg 53	Table at right. Switch No. 2. Change "overridden" to "not overridden."
MEO	PL pg 55	2nd column, 1st row. Add WR42 after WR32.
MEO	PL pg 58	NG21 Change F14 to F31.
MEO	PL pg 59	NG30 Add "any type steel."
MEO	PL pg 57	SA6 Change AN115-16 to MS20115-3 or to AN115-3. (Same thing).

OPT	PL pg 60	Static holes on both sides are optional. One side only is ok with a very minor error due to side slip (about 0.5 kt per deg).
MEO	PL pg 3	Lower left. Change 134.1 to 132.1.
DES	TR Cover	Change address & move nosegear back 6" on 3-view.
DES	TR pg 2	Change address. Change reference to "pk2" to "Plans."
MEO	TR pg 5	Change empty weight to 950 lb. Change limit "g" to 5 g. Ultimate is 7.5.
MEO	TR pg 5	Range with fuselage tank 375 mi. 555 mi. with added 12 gal long range tank.
MEO	TR pg 5&7	Change 300 ft to 400 ft.
MEO	TR PG 7	Change 85 KT TO 80 KT.
MEO	TR PG 12	Add weight = 1500 LB to upper graph.
MEO	TR PG 23	Delete all reference to Bede. Change Newton to Mojave. (805) 284-2645. Delete answer about kit, refer to RAF CATALOG.

NOTE: I strongly suggest that you write all changes into the plans from this list. Thus your plans will be updated even if you lose your newsletter and will contain no erroneous information.

MORE BUILDING TIPS

1. You don't need to strain your eyes on the grid on the vertical stabilizer ribs to get them cut out exactly the right size. Cut the top and bottom the correct size and make the others oversize. After they are mounted on the spars and the glue is dry make a 4-foot long sanding block out of a wood 2x2 with sandpaper glued along one edge. Run the block (held vertically) over the ribs to bring them down to the spars and into line with the end ribs. That tool can also be used to taper the top capstrips on the inboard wing and the fuselage formers to fit the skin.

2. Remember to get help on plotting the grid-drawn items up to full size. One person to read x & y dimensions from grid and one to plot (2 rulers help) directly on the wood. Several builders reported that they made all formers, canard ribs, inboard wing ribs and vertical stab ribs in less than 1 1/2 days work; a reasonably small percentage of the total job. Carrol Holzworth (S/N 2) reports that he found a large sheet of thin plastic, drew 1" grid lines on it, then used it as a full size grid to punch through to mark the parts. Be sure you are using the decimal 12" rule and tape measure, fractions are for carpenters!

3. One builder wanted to know why there are more and larger bolts on WA2 than on WA3. The reason is they are sized for bearing on the wood spar vs aluminum spar.

4. When drilling through the wood spar for the wing attach fittings use the following procedure: Clamp only the forward fitting in place. Be sure it's at the correct W.L. and B.L. Square the drill as well as possible (use a long drill bit and use a square) and drill only one hole. Then clamp the rear fitting on, installing a bolt in the first

hole. Now drill all holes in the front only drilling 1/2 way through the spar. Then drill about 2/3 through from the rear to complete the holes. On final installation be sure to fill the holes with epoxy to take up any voids due to hole misalignment. The epoxy is stronger than the wood and will assure full strength even if there is a little slop in the holes.

5. Glue the building jig to the floor to prevent shifting during construction. Install a tight wire at W.L. = 0 and B.L. = 0 for use as a reference in measuring. The wire is stretched along the jig, attached forward of F.S.20 and aft of F.S.200. A tape rule and good carpenters level can thus locate any B.L. and W.L.

6. Be sure you are using a good epoxy glue (see plans and Newsletter #1) coat both parts and put on enough for a generous fillet. Capstrips are not required on the canard or vertical stab. It's probably a good idea to use 3/32" or 2 1/2 mm hard birch ply on the canard top skin. This is not needed for any flight loads but the canard is used for handling the airplane on the ground. With the stick back you can reach over the canard and grab the canard trailing edge (not elevator) to pull the airplane. If you're already sheeted with 1/16" ply you may consider one light layer of fiberglass on top.

7. After trimming the canard skin adjacent to C8 spar, not too much overlap is left on the bottom. This can be reinforced with epoxy and cloth strips on the inside (Dynel, fiberglass, or even cotton). Don't do this everywhere, though, it can build up excess weight.

8. Charles Allen (S.N 047) substituted .063 4130 bent angles for C10. This is fine here, but the extra stiffness of extruded aluminum angles in most other places is required. 6061 T-6 can be used for C9 and E6.

9 I noted the bottom of the canard and elevators to provide inter-bay drainage and only used 3 drain holes on each canard and each elevator.

10. Wayne Koch (S.N 009) build a Gilliom 18" bandsaw and 6" sander from a kit. They look like quality tools at a real low price. I was impressed with his, so I'm building my own. Write for their catalog, 1109 N. 2nd St., St. Charles, MO 63301. The bandsaw needs to be modified to provide a slower speed for steel cutting.

SHOPPING - Here are a few helpful sources we've found or have been notified of.
1. Western Ply & Door still has good prices on the birth ply (See Chap 2). 50" x 50" sizes.
2. UNIVAIR, Rt 3, Box 59, Aurora, CO. 80010 has rebuilt Scott tailwheel assy #3200 for $70.00.
3. Harbor Sales, 1401 Russell St., Baltimore, MD 21320 has an excellent lightweight plywood (A/B OKOUME) in the thicker sizes (5/32" & up). Their 5/32" is light enough to be a substitute for birch 3/32". It is too soft to substitute where hard birch is called out. Send for their price list.
4. Spencer Aircraft, 8725 Oland Ave., Sun Valley, CA 91352 has good prices on hardware, I'm told.
5. Ask questions at your local EAA chapter meeting.
6. These outfits have catalogs with a very wide variety of needed parts, the first one is an absolute must: Aircraft Spruce & Specialty,

Box 424, Fullerton, CA 92632; WAG Aero, Box 181, Lyons, WI. 53148; Aircraft Components, Northshore Dr., Benton Harbor, MI 49022.

FLASH - "FLYING" MAGAZINE FLIES THE VARIVIGGEN - Peter Garrison of "Flying" magazine conducted a flight evaluation of the VariViggen for an upcoming article in "Flying," the largest general aviation magazine.

PARKING - Without pilot or copilot the cg is very near (slightly aft) of the main wheel location (with weight on the main gear its reaction moves aft of the no-load position shown in Chapter 19). Thus when the pilot gets out, he lets the aircraft down on the aft skids. At first we were ashamed of this tail-sitting attitude and would immediately tie the nose gear to a tiedown or install an aluminum tube tripod under one skid whenever we parked. I don't do this anymore for the following reasons: 1) sitting on the skids, the center of pressure is well centered and the aircraft will take winds from any direction with little weathervaning or upsetting tendency common to the conventional parked aircraft, 2) when parked in a hangar even a low wing aircraft will overlap all the way to the fuselage and thus a VariViggen will take up considerably less room than even smaller homebuilts (I've put it in many hangars after the owner said "sorry we're full," without even moving other airplanes!)., 3) this attitude allows more convenient preflight inspection of fuel, oil, landing gear and pulling the prop through, 4) baggage loading, fuel and oil loading is convenient while on the tail, 5) it is very easy to pull the nose down by the canard tip, step to the ladder and get in when ready for ingress, 6) we consider it a "status symbol" - just one other thing no other plane on the field can do! However, for an airshow, in order for people to more easily inspect the cockpit, we either tie the nose gear to a tail tiedown rope (VariViggens park backwards, too!) or retract the nosewheel only (pull the main gear breaker) and set it clear down on its nose. Thus, the canard is an excellent seat for four to watch the show!

ENGINE Selection - Since I mentioned I would like to have 180 hp in Newsletter #1, alot of you have thought it was for more speed. Not true, considering 75% power cruise, speed would only increase 10 mph with 180 hp. The main reason would be for better rate-of-climb, particularly at high altitude. Remember, low aspect ratio means lower climb performance. A VariViggen will not climb as well as a conventional aircraft with equal cruise speed and hp/weight ratio. Those that want better high altitude climb performance and want to use a heavier engine or constant-speed prop will find the airplane tailheavy and for that reason I have not recommended them, due to the terrible requirement for lead in the nose. There is a better solution, however, that can eliminate this problem. I used this solution when I found my partially completed airplane to be tail heavy. The original design had a shorter wingspan. I increased the span of the outboard wing panels. This moved the allowable cg range aft, thus solving the problem without lead. A disadvantage is a slightly reduced g-capability. If you are interested in using a constant-speed prop or heavier engine, send me the weight, length of engine, and weight of the

prop. I will then calculate for you the amount of extension to the wingtip, show how to make the extension and calculate the amount of reduction in allowable 'g'. Please also include $6.00 as consulting fee for this design change. This can only be done up to a point at which the control power of the canard is reduced and the overall cg range is too small. While this solution is better than lead nose weight, I still recommend 150 hp (180 hp for short airstrips or high density altitude flying) and a modern light weight wood prop.

MODIFICATIONS - As you know, it has been our policy to not be adverse towards those who want to modify the aircraft. We have had this policy mainly in the interest of promoting education and design progress. However, we have seen some examples of modifications, even some under construction that will result in disappointing performance and in some cases unsafe flight characteristics. In all cases those individuals designed their modifications by aesthetics and by eyeball rather than by valid engineering calculation supported with appropriate tests. In most cases, when I was able to point out the disadvantages and calculate the effect on performance and stability, the author of the change decided to stick with the plans. One builder doubled the rudder area and didn't even know that that would reduce overall directional stability due to rudder float.

I must modify my policy to point out that I am not adverse to anyone modifying the airplane that is qualified (or finds qualified help) and is willing to conduct the analysis and tests required to verify the modification before flying his aircraft. I am very adverse to those who may give all the rest of us a bad image by building a "VariViggen" that either has poor performance or contributes to an accident statistic under the name VariViggen.

A plans-built aircraft has good utility and excellent flying qualities. Modifications that add weight, be they as subtle as extra heavy gussets everywhere or fiberglass over the wood skin, or more substantial like 70 gallons fuel or four place, etc., etc., can result in very disappointing climb performance at high altitudes. Our experience in flying N27VV over 400 hours in all kinds of flight conditions, runways, weather, density altitudes, etc., is very valuable and we have found that due to the low aspect ratio (necessary for optimum low speed flying qualities) the airplane should have a lower weight-to-power ratio than conventional designs. You cannot expect to carry four people and more fuel adequately from Albuquerque in the summer unless you use at least 200 hp.

You cannot expect the same safe flying qualities if you stretch the nose sever feet for "looks." This would decrease stability and actually slow down the aircraft! You cannot just assume that a beautiful flush inlet three inches from the top of the wing will provide adequate cooling. My measurements during development of an oil cooler system showed terrible pressure recovery during low speed.

I should point out that because with a canard aircraft both surfaces are lifting wings (the canard actually has a much greater wing loading than the main wing) their size, position, interference with each other, high lift devices, etc., have a very important effect on the cg range, the flying qualities, and low speed performance. Their design is far

more critical than with a conventional aircraft with one main lifting wing (sized for performance, etc.) and a tail sized

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merely to provide adequate static margin and sufficient cg range. For example a formula-one racer has an extremely small tail - but it can be designed for one cg only and still provide adequate stability and sufficient control But if it were a canard, the designer would have much less room for change, to provide a large flight envelope (speed range and maneuverability) even for one cg.

Therefore I am unable, without conducting the appropriate test to answer a question like "is it ok to move the canard down eight inches to clear my extra radios in the instrument panel." I am not adverse to you making the change, however, if you are willing to conduct the test and verify its satisfactory result. The car-top wind tunnel system which will be available this December is an excellent method, others are also valid.

Remember, this aircraft was not developed by "guess work" but by a very careful design-test program. Small changes can be full of "surprises." If you modify an aircraft, when it is ready to fly, you are an experimental test pilot, not a production test pilot - be prepared to accept the full responsibility to safely plan and conduct exploratory testing and critical flight envelop expansion - for there are no proven limits on your airplane.

I don't mean to inhibit progress, only to promote valid development. In this way we are also promoting education, which is what EAA is all about!

NASAD - The VariViggen plans have been submitted for approval by the National Association of Sport Aircraft Designers. Several areas of information are required that were being reserved for the VariViggen Owner's Manual. This information is being distributed to all plans holders now in order to qualify for NASAD approval before the complete Owner's Manual is published. The information in the Owner's Manual will be more detailed and will include information in several other areas (see Catalog).

VARIVIGGEN AIRCRAFT
MAINTENANCE/INSPECTION/OVERHAUL/CHECKLIST
MAIDEN FLIGHT PROCEDURE

MAINTENANCE/INSPECTION

Wood Structure - Wood structure, properly sealed with the epoxy specified or with a good grade of varnish, will provide years of service with no maintenance, especially when hangared. Periodically check all visible surfaces for cracks or ships in the finish that indicate either degrading protection or internal damage. Check that all moisture drains are open. Remove the outer wing panels once per year to inspect inboard wing internal structure through WR46 rib.

Metal Structure - Periodically inspect rudder and outer wing panels for skin buckles or loose rivets that may indicate internal damage. Check that all moisture drains are open (none required on foam filled ailerons). Inspect outboard wings for internal damage and corrosion through ribs with panels removed once per year.

Plexiglass - Cracks up to three inches long should be stop-drilled 1/4" outside of the visible end with a 1/8" dia drill. Larger cracks require replacement (N27VV has had no cracks).

Mechanical Components - All controls and reflex/gear pivots that are sealed bearings or oilite bushings require no lubrication. Check periodically for any excessive slop or binding. Check all cables annually for any signs of fraying or wear. Replace any frayed cable. Grease main gear, external gears, reflex screwjack, NG23, MG16 bushing, and MG31 zerks with automotive grease every six months. Periodically check main gear shock doughnuts and all tires for excessive cracks. Inflate main gear tires to 36 psi and nose gear tire to 40 psi. Periodically clean nose gear shock strut and service as shown on plans, page 45, once per year. Check brake fluid level and brake puck wear twice per year or every 50 hours of flight time. Check all landing gear, engine mount, and control system structural parts for damage or cracks each 50 hours of flight time. N27VV required only routine maintenance and one brake shoe and tire change in its first 300 hr/2 years.

Electrical - Check for loose or chafing wiring every 50 hours flight time. Follow manufacturer's recommended maintenance for battery.

Engine, Propeller, & Instruments - Follow manufacturer's recommendations.

OVERHAUL

Engine, Propeller, & Accessories - Follow manufacturer's recommendations.

Gear & Reflex Motors (MG39, NG4, & RM9) - Replace every six years if aircraft is hangared and every three years of not hangared.

Wheels & Brakes - Follow manufacturer's recommendations.

CHECK LIST

Preflight

1. Ignition - off
2. Remove gust locks
3. Remove tiedowns
4. Check control surfaces
   (freedom & security)
5. Check landing gear & tire
6. Check fuel & oil quantity
7. Under cowling - nothing

hanging or dripping
8. Drain strainer
9. Prop (nicks & security)
10. Pitot static - clear
11. Gear handle down
12. Master on - check reflex operation & instruments

Engine Start

Follow manufacturer's recommendations

Before Takeoff

1. Fuel - on
2. Mixture - rich
3. Mags & carb ht
4. Trip - T/O
5. Reflex - 8 deg
6. Ammeter - chg
7. Gear - handle dn, 3 green lights
8. Controls - free
9. Engine inst. - green
10. Circuit breakers
11. Harness - both seats
12. Canopys - locked

Before Landing

1. Mixture - rich
2. Carb ht - A/R
3. Reflex - 4 to 8 deg
4. Gear - dn, 3 green lights, visually check mains
5. Airspeed 65 to 75 kt on final

Securing

1. Avionics - off
2. Master - off
3. Mixture - cutoff
4. Ignition - off
5. Gust locks - on
6. Tiedowns

MAIDEN FLIGHT PROCEDURE

Ground Tests - Run engine on ground at lease one hour. Check for sufficient fuel flow at full throttle and minimum fuel quantity. Taxi enough to thoroughly check engine, brakes, controls, landing gear, and to become thoroughly familiar and comfortable in the cockpit. Recheck weight and balance (see operating limitations).

High-Speed Taxi - Weather - smooth air, no crosswind. Runway requirements - smooth, at least 4000 ft for initial tests. Reflex - 8

degrees. Make several runs as follows to speeds of 40 kt, 45 kt, 50 kt, 55 kt: Accelerate to aim speed; reduce power to maintain speed. Lift nose wheel off about one ft above the ground, check directional and pitch control, rock wings (with mains still on the ground) to get the feel of roll control (nose may not rotate at 40 kt). When you feel you can comfortably control pitch attitude up to one to two ft nosewheel height, you are ready for lift-off. Accelerate to 60 kt, reduce power to about 1/2 throttle, rotate nose and fly down the runway at an altitude of several feet. Reduce power very slowly to idle once airborne (slowly, so you don't have to adjust for abrupt pitch trim changes, if any). The airplane exhibits a pronounced ground effect and may float a long way down the runway. Its best not to make a "full stall" landing (aft skid clearance), just lower it to the runway. Ask yourself - is the airplane out of trim directionally or in roll? If not, you're ready for the first flight.

First Flight - Once the lift-off and flight down the runway is accomplished, the hard part is over. The actual takeoff, full flight, and landing are much easier. I still recommend smooth air and a large smooth runway. The following is a description of the prototype's (N27VV) first flight: "As the Cessna 172 chase plane maneuvered into position, I started my take-off roll. Take-off (at 50 kt) and climb (at 80 kt) were normal and a very strange feeling came over me as I cleared the end of the runway. The air was absolutely still and there I was climbing straight ahead. I had waited a long time for this moment, but somehow it felt like I was on my first solo. I had to rock the wings to convince myself I was really flying. I leveled off at 1500 ft AGL and performed some stability checks - static and dynamic and pleased with the results proceeded to do sideslips and maneuvering turns. I set the reflex at several positions and slowed up to near full aft stick to check low speed handling. Again the aircraft felt solid, while still responsive - particularly in roll. So much for the "work", I moved in close to the Cessna for some pictures, then made a low pass down the runway and landed just a sunset after 50 enjoyable minutes of flying." Best final approach speed for first flights is 75 kt.

DO NOT forget to send us your change of address if you move. If you have a question that requires our answer, send a self-addressed, stamped envelope. Be sure to send any comments or suggestions for the newsletter. Also send us your builder tips and photos. Items to be covered in future newsletters: details on new cowling, long range fuel tanks, alternative aileron construction eliminating foam, cabin heater, ingress ladder, improved carb heat muff, external wood finishing procedure, and anything you suggest!

Burt & Carolyn Rutan

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Charles Allen S/N 47. Canard ready for cover.

Charles Allen, Elevators.

Jim Cavis S/N 31, June 74

N27VV Ready for bottom cover

N27VV in configuration for its first flight. Note tip plates and no cowling.

N27VV parked on its tail at a dirt strip in Kansas.

N27VV ready for outboard wings summer 1971.

VARIVIGGEN NEWS NO. 3 Jan 75

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(805) 824-2645

THE VARIVIGGEN program is now in high gear! We are very pleased to see the great number of excellent projects under construction. As of this writing we have received the plan's "page two" from 218 builders indicating that they are building or are planning to build. (Those of you with aircraft serial numbers have the updated builders list enclosed with this newsletter.) We estimate that about 150 projects are now in the construction stage.

The following are photos of projects sent to us. We encourage all of you to send photographs for the newsletter (black & white), also, how about everyone with a project underway, sending a photograph and caption to Jack Cox, Editor of "Sport Aviation" (Box 229, Hales Corners, WI. 53130) for insertion in the "What Our Members are Building" section of the magazine. Also, "Sport Aviation" periodically prints a list of projects under construction. Send Jack your name and address and mention you are building a VariViggen. 150 builders on the next list would look real impressive!

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Ken Guscott's Fuselage S/N 129 Dec 74

This shot from the back seat shows that the rollover structure does not block visibility - Photo by Peter Garrison

New emblem on N27VV. Drawn by Jerry Slocum

Charles Allen's Fuselage and Canard, S/N 47, Nov 74

J. Scheibinger (S/N 196), just for fun set his canard on the nose of his Volmer amphib!

Carrol Holzworth's (S/N 2) canard & elevator ready to mount on fuselage.

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I didn't really think anyone would build the landing gear first, but Mike Melville (S/N 115 did. Excellent work, Mike. He's done with the inboard wing and most of the control system and may be the first to fly!

PHOTOS OMITTED

CONSTRUCTION MANUAL. For sometime now we have been wanting to provide photographs of the construction details. Since we did not take these

during the construction of N27VV, we had been looking for a project on which to begin the photo series. Jim Cavis, S/N 031, has agreed to not only get professional quality detailed photos, but to write a construction manual with detailed information on tools, jigs, materials, construction hints, etc. This will be similar to the type of information on pages 11 and 12 of the plans but very detailed and expanded to about 30 pages, referring to approximately 75 detailed photographs. It will be published in two parts. Part one (fuselage, canard, inboard wing, vertical stabs, control system, and landing gear) should be ready by March or April and will include drawing changes to use the larger AN 220-2 control system pulleys which are much easier to obtain than those shown in the plans. Part two (outboard wings, canopy, engine installation, instruments, electrical system, seats, and fuel system) should be ready by about the end of the year. Price for the manual will be between $15 and $25. Complete details will be in the next newsletter. The following is a sample of photos from Jim's project taken in December. He now has the entire control system installed and is working on the landing gear.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Left Inboard Wing

Rear Stick Area

Looking aft in baggage area

Spar G looking aft

- - - - - - - - -

VVN3, Page 2

ACTIVITY with N27VV has been almost nil for the last two months since we have had it in the shop to develop tooling for the fiberglass parts and exhaust system. Before N27VV was hangared though, Edwards Air Force Base invited us to participate in their open house display last November. The VariViggen blended in well with its red, white and blue, and fighter appearance. Also, writers Bill Cox, Don Dwiggens, and Peter Garrison did flight evaluations of the VariViggen that month. Keep watching for articles in "Flying", "Plane & Pilot", and "Science and Mechanics."

We are planning to have N27VV flying in time to take it to San Jose, where we are guest speaker at EAA chapter 62 banquet meeting on February 15. We have been giving several presentations to EAA chapters and other interested groups. Then we will be filming a movie sequence for a film which depicts the 1990's. The VariViggen strafes and bombs a futuristic-looking car in a desert canyon area, then crashes - the crash is done with a model, of course!

The airplane will then be inactive again for some improvements (see special performance), then we plan a U.S.A. tour with many stops, including of course, Oshkosh '75. We'll have more information on where and when in a future newsletter.

VariViggen plans have received NASAD approval in AA category.

COMPONENTS. We are behind the schedule we made in October for supplying the machined parts and fiberglass parts. What we thought we could do in a month has taken two or three (kinda like building an airplane!). the good news is that the machined parts for the first 25 airplanes are complete and they are beautiful. All steel parts are cat plated and baked. The nosegear strut is hard chromed and precision ground. Some builders have found it difficult locating the O-rings, backup rings, and scraper for the nose strut, so we have stocked up on these and can supply them with the nosegear housings. We also plan to build the NG36 scissors and NG20 'Y' bracket in machined aluminum with bushings to replace the welded homebuilt. Thus, we will be supplying the complete nosegear with the Scott assembly. We plan to offer this complete nosegear to builders of other aircraft types, but only after VariViggen builders have been supplied. Availability is now for the machined parts shown as "immed" in the catalog for the first 25 sets. The second production run will be available in one to three months.

The fiberglass parts will all be made in first-class tools being prepared by Fred Jiran, well known in the sailplane crowd for his excellent work with European, glass sailplanes. All tooling was redone from my prototype molds at considerable expense, but the result will be much higher quality parts without the waviness seen in N27VV's parts. All parts will be supplied in primer gell coat finish. The visor part (F27) has been modified, raising by one inch the portion which connects to the leading edge of the windshield. This results in a better looking, further-aft slanted windshield, more instrument panel space, and a smoother matched mold line to the nosecone. If you have not already cut out the top edge of F41, leave it about 1 1/2 inch taller than on the plans and trim to fit F27. If it is already cut, it is a simple task to scarf on an extension. F20 can be notched down between the longerons to provide clearance for long radios or instruments to extend out over on top of the canard aft spar. Notching F20 all the way to flush with the canard top will not weaken the structure. While the external fit should not pose a problem, it is suggested that you trial fit F27 before skinning the fuselage sides so any builder tolerances can be trimmed out.

The cowling tooling was a considerably larger task than we had anticipated due to the changed mold lines to enclosed the new exhaust system. In the design of the new cowling we made two decisions that will reduce the cost of your aircraft by over $200. First we are not using a prop extension. I originally thought this would be justified to provide a better looking aft closure. However, after finding that the prop extension now costs over $100, we modified the cooling outlet to provide a well-streamlined aft mold line without moving the prop aft as shown on the plans. Also, we are not using an expensive aircraft exhaust system. Instead of an expensive aircraft muffler, we used a simple manifold terminating in the center under the prop with the multiple hole outlet. The entire system was made up from stock bends (available at Midas) at a materials cost of less than $12. It's quiet and located so no exhaust-prop impingement occurs. The cowling is less bulky than it would be with a standard aircraft exhaust system and, best of all, you don't have to but the exhaust system - have you priced them lately? Full details and pictures will be supplied after all tests are completed.

We could produce cowlings by February 15, but we will not start production until all flight tests on the prototype cowling are completed, thus we expect cowling availability toe in mad to late

March. F23, F28, and F27 will be available by March 1. We only plan one master tool per part so all fiberglass parts can be made at a rate of only one set per day.

The following items are still planned, but we cannot schedule their production until we have a better idea of the demand and can afford the investment in tooling: V-MG19, V-MGMA, V-RMA, V-MG14, VVSC, Engine Mount, Fuel Tank, Exhaust System.

The car-top "wind tunnel" manual availability has been delayed until this summer. We built the new prototype system (see photos) but experienced failures with one type of the potentiometers used, after about five hours testing. A redesign is required, plus the demands on our time are preventing us from completing the textbook at this time. We were quite pleased with the new "wind tunnel" system as it gave us very accurate data in developing the aircraft shown in the photographs, which is a design we are building in order to break the existing world records for distance and speed in the under 500kg weight class.

We are also delaying the Owners Manual, for a different reason, though. FAA is now proposing that homebuilts fall under a new set of regulations for custom built aircraft in which a builder can do his own annual inspections and maintenance if he has a "repairman's certificate," given only to the builder. If you buy your completed homebuilt from someone, you would have to have maintenance done by an A& P mechanic. Also required is a manual. There are several different proposals for the manual format and contents. One by FAA, one by EAA, and still another by NASAD. As soon as it is decided what the regulation will specify, I will arrange the VariViggen Owners Manual to match, including all additional information specified in our catalog, of course. If FAA still has no regs by this summer, we'll publish it anyway, since it has alot of important information for VariViggen operation.

PHOTOGRAPHS OMITTED

SPECIAL PERFORMANCE WING. We have started construction on an entirely new outboard wing panel design for testing on N27VV. First, a little background: We have done extensive testing on a new construction method using urethane foam and hand layup unidirectional fiberglass. I do not mean the Rand formulae of wood construction with foam and Dynel surface development. We actually make a tapered spar very easily by laying up layers of unidirectional glass, carve a wing using only three rib/templates, and cover with two crossed layers of thin unidirectional cloth. this method is light, strong, requires no particular skills or tools, and best of all, can be done in about 1/4 of the man hours required to build the metal wing. If this system meets test expectations, we will supply plans for outboard wings and rudders, thus taking the aluminum construction totally out of the design. A small cost savings is also possible. Since the unidirectional glass with the epoxy surface treatment is somewhat difficult to obtain in partial rolls, we are importing a large quantity from Europe and will make available kits for the outboard wings and rudders. No aircraft-quality wood is required.

Now, for the really big news - the aerodynamic design of the wing panel. The original panel is a very, very conservative design from the stall standpoint, and retains the flat bottom out to the tip for ease

of metal construction. Now that I have actual flight test data, I can design out some of the unnecessary stall margin, and reflex and twist the wing for optimum performance. I wouldn't recommend this for a new design, but it can be done with low risk, using actual flight test data. Considering the trip requirements, and designing for best climb and cruise performance without excessively reducing the G-capability, I have arrived at the following design and have started construction:

	Original VariViggen	VariViggen SP	Increase
Span ft	19	23.7	25%
Area sq ft	119	125	5%
Aspect Ratio	3.03	4.47	47% !
Span Loading	89.5	71.83	-20%

SKETCHES AND GRAPHS OMITTED

Conservatively, we estimate a 25% increase in rate-of-climb at gross weight and a five to seven mph increase in cruise speed. That's almost 180 hp performance on the 150 hp engine! As you can see from the sketch, the new wing has a 15 gallon aux. fuel capacity. It will fit the inboard wing built to your plans and uses the save V-WAA (WA2 and WA3) wing atch. assembly as is used on the original outboard wing. It will also tie in directly with the current design AB10 aileron pushrod and should require no other changes.

In addition, we are going to incorporate the recent NASA-developed "winglets" developed by Dr. Whitcomb in an attempt to further increase rate-of-climb. In summary, if the SP works as I think it will and retains the stall safety, we will have a very competitive performance aircraft to go along with our already superior handling characteristics. But that's an if, so please don't bother us alot with further questions now; we should have test data and a decision whether to make plans available by Newsletter #4. I do suggest that you hold off on purchasing materials and building the outboard wing if you have not already done so.

OTHER Modifications - True, the VariViggen is not a 4-place airplane, but it can easily be made into a 2 + 2 configuration with plenty of room and visibility for a 140-lb wife and one or two children, combined weight up to 110 lb. The sketch is self-explanatory. This is the best way to add some family utility without compromising cruise performance. Scaling up the outside dimensions to add more people will result in either slower speeds or higher fuel flow, depending on engine selection.

SKETCH OMITTED

As a two-place, the rear seat area is much larger than is usually needed, and a relatively minor modification can be made to increase fuel capacity, baggage capacity, and still hold a 6' 4" back seater in relative comfort. Again, the sketch is self-explanatory. This is probably the best way to increase range, since it does not add any complexity to the simple gravity-feed fuel system.

SKETCH OMITTED

ADHESIVES. I am still hearing about some builders using obsolete wood adhesives and varnish. That was S O P years ago, but inexcusable now that modern epoxies are available. With modern epoxies, the wood structure should last indefinitely. Here are two more very good adhesives: 1. FPL glue 16-A, available from Aircraft Spruce, Bx 424, Fullerton, CA. 92632, at $11/qt or $29.90/gal; 2. West System Epoxy, available from Gougeon Brothers, Bay city, MI. at $19.95/gal plus $5 for hardner (specify 206 hardner for 40 minute pot life). This latter one sounds excellent as it has a relatively fast cure of six hours and can be used as low as 40 degrees F temperature. It's a 5 to 1 mix, has a relatively low viscosity, and can be used directly for painting structure. It provides a 100% molecular bond between coats without surface preparation. For gaps over 1/32", it can be thickened with "401 fibers" (1.90 for a bag - enough for the entire aircraft) to fill even large gaps without
decreasing strength. Send Gougeon Brothers an extra $ for their manual on this epoxy system. Pastor Jenkins, S/N 177, is using it on his VariViggen. He completed his fuselage structure and canard in only 12 days!

PLANS Changes - Be sure to incorporate these revisions into your plans Now.

Location - PL - Plans
TR - Tech Report
NL - Previous Newsletters

Category - MEO - Minor error or omission
OPT - Optional improvement
DES - Desirous change - Does not effect flight safety but should be incorporated to improve aircraft or correct a fault
MAN - Mandatory change - Must be incorporated as safety of flight is affected

Category	Location	
MEO	NL2 pg 2	Change phone # to 824-2645.
MEO	PL pg 11	Center of page, change "W.L.18" to "W.L.22".
MEO	PL pg 4	Furane Plastics has closed their N.J. office.
MEO	PL pg 4	Western Ply & Door Co. no longer uses "Western" in their name.
MEO	NL2 pg 3	Wrong address for Spencer. Use the one on plans pg5, 8410 Dallas, Seattle, WA. 98018.
MEO	PL pg 50	Newsletter #2 changed the 1.63 and 1.7 dimensions to 1.75 because we found some belcrank bearings (MG7 - MS20218-2) with an outside flange of 1.75. Since then I purchased some MS20218-2's from Arts Surplus (address on plans pg 5) for $.75 each, that have a flange diameter of 1.67 which is the correct O.D. shown in the mil spec. We are machining the RAF-supplied MG5 & MG4 parts to fit the 1.67" bearings. If you are building

		your own MG5 & MG4, I suggest you get the MG7 bearing first, and fit the inside diameter to a slip fit on the bearing with a chamfer to clear the bearing radius. The RAF-supplied parts accomplish this.
MEO	PL pg 18,38	Some of you have found interference of the SA1 stick torque tube with F63 bulkhead. F63 should be modified in the center to have a notch rather than a hole to allow the tube to fit higher. If F63 is already fabricated, cut out the top edge and install a doubler plate as shown in the sketch. Also, to provide more clearance, you can move the entire stick assembly down by increasing the .8 dimension on SA12 & SA13 to 1.0 inch (plans pg 38). **SKETCH OMITTED**
MEO	PL pg 25	SPAR G - 2.3" dimension should be 2.5" so spar comes flush with the capstrips that cover rib WR25. This taper on spar G can be trimmed after installation to fit flush with the capstrips.
MEO	PL pg 38	Tube sizes on Detail A are incorrect, change to 3/8 x .063 spacer clamped by bolt & 1/2 x .063 spacer welded to SA2.
MEO	PL pg 42	RB2 - the 1/4" hole callout is wrong - should be drilled to be riveted to belcrank bearing the same as AB4, pg 40. A 7/8" hole & rivet pattern to fit RB5 is required.
MEO	PL pg 5	Cotterpin AN 330-3-3 should be AN 380-3-3.
MEO	PL pg 42	Cleveland Tool Co. no longer makes ball screw actuators. The correct part is RO 308, ask for 1/2 ft of screw and the RO 308 ball-nut assembly (about $45!) from Los Angeles Rubber Co., 2915 E. Wash., L.A., CA.
MEO	PL pg 25	Cut holes in WS24 outboard end for the landing gear cables before glueing in. (Notch in about 1" where it butts to WS7).
MEO	PL pg 53	Diode number omitted. Can be # 2761135 from Radio Shack. Also RG58/U can also be RG58/C or RG58/AU.
MEO	PL	2024 T-3 & 2024 T-4 aluminum callouts are reversed in several places in the plans. These are interchangeable in all cases.
MEO	PL pg 11	First column, change "quarter square" to "triangle".
MEO	PL pg 13	Antennae rods are 14.15" long. Don't scale dimension from drawing.
MEO	PL pg 18	F63 outside edge is drawn at B.L. = 12.25. This should be B.L. = 12.4. If you have already cut out F63, just ship out about 1/8" wider with 1/8" ply strips.
DES	PL pg 45	The forward bolt passing through NG37 cannot be tightened down hard without binding NG20 & NG36. While this has presented no problems on N27VV, it is a poor design practice & I am improving it by providing a spacer for the bolt to tighten on. The spacer can be 5/16"

x .035 steel tube drilled out to press onto the 1/4" bolt. Drill out NG36 to 5/16" to fit over the spacer. I also strongly suggest a short length of 3/8" tube welded in the arms of the NG20 "Y" bracket to provide a better bearing surface. Also note that NG36 center pivot must be offset to prevent interference when the strut is deflected. Thanks, Mike Melville, S/N 115, for these suggestions.
SKETCHS OMITTED

VVN3, Page 6

BUILDING Hints - Most of these were suggested by builders. If you have suggestions, please get them in for Newsletter #4.

Build the fuselage and/or inboard wing jig at W.L. = -3 instead of W.L. = 0 to facilitate installation and removal of parts without having to notch the jig.

F10 can be bent in place if done in the order stated on pg 11, but it takes alot of clamps since it is relatively stiff. you can saw notches in F10 about 1/2 way through, every 2 inches from F.S.22 to F.S.48 to make it easier to bend. The strength along F10 is not needed. Its primary function is to tie F11 and F15 together.

When permanently installing Spar E, glue in WS2, WS5, WS6, WS7 and WS9. Let dry. Then bend WS1 over to fit and glue in WS1, WS8, WS10, WS3, and WS4. This keeps the bend in WS1 from deforming the flat bottom.

Urethane foam (2 lb/cu ft) can be substituted for the balsa everywhere. Cover with one layer of 9 oz fiberglass - go easy on the resin, it's heavy.

PE2, pg 39, can be fabricated easier in two parts and overlapped in the center thus: **SKETCH OMITTED**

The nutplates for PE2, pg 39, are hard to get at, after installing WS3. Install them on F152 before installing the wing spar.

F5 is cut curved, not bent.

90 degree or 45 degree plywood is okay. I used 90 degree throughout.

A good stapler for skinning is the Aero T50. Use 3/8" long staples. I took a large screwdriver and ground a scoop shape on the blade to use as a scoop to pry the staples out once the glue is set.

Due to their slant, bulkheads F41, F70, F91, and F121 come out short when the waterline drawings on pg 17, 18, and 19 are used as patterns. Some builders have made them short and just adjusted in place by notching up the longeron slots and shimming the top. This is perfectly fine, but if you haven't cut yours out, here are the dimensions for bulkhead patterns which should fit quite well.

SKETCHES OMITTED

Tom Hendricksen, who is building S/N 169 with a "full" IFR instrument panel, sent in his panel layout and a modification to mount the panel further aft, to provide clearance for the longer radios. Note that F27 visor does not quite extend to cover this panel but a small extension could be added.

SKETCHES OMITTED

SHOPPING

Stolp Aircraft, 4301 Twining, Riverside, CA 92509 has 2024 alum extrusion angles.

Columbia Airmotive, Box 436, Trout Dale, OR 97060, (503) 665-4896, has good prices and stock on hardware and has the 500-5 wheels and brakes for about $115.

G & J Aircraft, 1115 So. Sultana, Ontario, CA 91761 (986-6534) has good hardware stock and good "scrounging" prices.

Wicks Organ Co, Highland, IL 62249 will supply spars cut to size and has a complete plywood stock.

J & M Aircraft supply, 1014 Joseph St., Box 7586, Shreveport, LA 71107 has a good overall hardware and materials catalog - send for it.

Plywood & Door Co., 1555 Santa Fe, Long Beach, CA has birch 1/4" plywood 5-ply with outdoor glue for only about $.35 per sq. feet! This is not aircraft ply because it has some patched imperfections, but is still excellent quality and perfectly adequate. They also have a complete line of all plywood sizes, aircraft and non-aircraft - write for list, or go see them if you can. They deal only in plywood and service is good.

Wiebe Wood Products (Newsletter #1) price per quart of M666 Epoxy glue is now $8.50 plus postage. Mr. Wiebe tells us that the price will probably be going up again, but that he will continue to supply our builders as best he can and will keep the price as low as possible.

FLIGHT Test Assistance - We are planning to provide a pre-first flight inspection and initial flight test assistance service for our builders. This would involve us visiting your flight test area, giving your aircraft a very complete inspection, and rigging check, prior to first flight and either flying your first flight or checking you out in N27VV to improve your proficiency for your first flight. Providing flight test assistance in expanding the flight envelope of your airplane would also be very beneficial in assuring flight safety. This service will only be provided to those who are building the airplane without major modifications from the plans, and flight envelope expansion on your aircraft will be limited to the envelope shown in the aircraft operating limitations, plans page 3.

We will provide this service to the first three builders who complete their aircraft, free of charge except for transportation costs. Transportation costs may also be eliminated if we can work it to coincide with another trip.

Clarification of placement of WR12.6 with respect to fuselage. It's probably best to install WR12.6 capstrip after skinning fuselage sides. Fuselage skin should extend about 1/4" to 1/2" below wing top. Fuselage skin is notched to fit over wing spars. **SKETCH OMITTED**

BARTER Corner - Everyone is welcome to a free ad for this section, after all, it's your newsletter.

Jim Cavis reports he can sell the Pointer portable model 3000 ELT with voice modulation for $96.00 FOB Phoenix. That model lists for $160.00. Contact him directly at 8344 E Turney Ave., Scottsdale, AZ. 85251.

Charles Allen would like to trade a set of new Cleveland 600x6 wheels and brakes for 500x5, or will sell for $75.00. He's also looking for an O-320 and the Scott nose wheel. Write to him at 1022 Hoedel Ct., Lafayette, CA. 94549.

Jim Brunson, 5225 W. Ave. L-2, Lancaster, CA. 93537 has an O-320 Lycoming for sale.

Ken Winter, 1538 E. 66th., Tulsa, OK 74136, S/N 133, has a partially completed BD-5A for sale.

PARTS LOCATOR CHART OMITTED

VARIVIGGEN NEWS NO. 4 APRIL 75

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N27VV has seen a lot of action since newsletter number 3. We've logged nearly 100 hours on the new cowling, including trips to San Jose, Watsonville, and Flabob, Ca.; Phoenix, Az.; and Las Vegas, Nv. In addition, I flew the action-packed chase and bomb scenes for the movie "Death Race 2000," which opened April 30 in theaters in the Los Angeles area. We had a lot of fun doing the film, which required many hours of flying, doing close-in passes on race cars. On many of the passes, explosions were set off around the car just as I pulled up. The model used for the crash scene was built from our R/C model plans. The movie is rated R, so be ready for a little crude language and nudity.

A lot of our recent flying has been to give rides and to put time on the new cowling. The cowling has added more performance than I thought it would and cools the engine much cooler than the old configuration. I'm now cruising at 152 mph at 75% power at 7500 feet with the external fuel tank, which means 155 without the tank. When we fly the new SP wing we expect to cruise close to 160 on the 150 hp Lycoming.

The VariViggen was featured in May issues of "Flying," "Private Pilot," and "Plane and Pilot" magazines. As for our comments on the articles, I think they were well done with a few exceptions: The VariViggen does not lose altitude during a power application at normal approach speed and is not control limited as John Olcott mentioned in "Flying" (a retraction has been sent), and Don Crane did not make a full aft stick circuit and landing (that's not hardly recommended for a checkout!). Watch for another article in a future issue of "Mechanics Illustrated."

Scheduled dates coming up include presentations at EAA chapter 40's meeting at Van Nuys, Ca., June 13, and the AIAA/EAA symposium at Boeing Field in Seattle, Wa., June 28. We'll also be attending the Porterville (Ca.) flying, June 16, and Oshkosh flying, July 29 to Aug. 4. Ken Ashdown (SN 069) from Ontario, Canada, will be giving a technical presentation on the VariViggen at the First Canadian Symposium on Recreational Aircraft, Ottawa, Carleton University, June 23-25.

Another article about N27VV was written in the "Hangar Flyer" publication by Don Pridham, editor of EAA chapter 92, Orange County, Ca. His comments are reprinted here:

"When we arrived at Flabob, the wind was still calm, but that nice state of affairs didn't last long enough. A REALLY strong 90 degree Santa Ana wind came up for quite awhile there, and everyone walked out near the runway to watch the sheep and goats being separated... At

about the height of the wind gusts, Burt Rutan and the VariViggen came zapping into the pattern, came down like he was riding a string, painted it onto the runway without a trace of strain, pain, crabbing, slipping, or anything, turned off in about 6 lengths from touch-down, and taxied effortlessly past toward the tiedown. In the back seat was his enthusiastic and charming wife, Carolyn, and BOTH of their girls!

I kinda remember seeing and talking to a large number of you friendly folks up there, looking at bunches of fine craftsmanship, and eating some excellent food prepared by Chapter 1, but what happened next sort of erased my mind totally on most other happenings. Joel Confair and I finally found Burt Rutan, who had been very busy fielding the myriad questions about the VariViggen. Joel had wanted to verify the time and place for our next meeting with him. Out of the blue, Burt says, "Don, how'd you like to take a ride in the VariViggen?" My jaw drops. Joel's drops further. "When?" "How about right now", he says. My mind is already popping circuit breakers as I'm thinking what Joel is mumbling (something about who's the Pres.) I consider of course stepping back, bowing a bit, and offering to let Joel go instead ---- HOWEVER, I have to live closely with a person who would never stop kicking my butt if I didn't go. ---ME! (So now I finally know -- when it gets down to me or somebody else for the goodies, it'll be me every time. Hah, the old id is really there, just like the shrinks say it is!)

So in a numb hazy smiling kaleidoscope we belted in, taxied out staring at a few hundred camera lenses, and made an unreal take off. I watched the elevators very scientifically, and he brought them way down to lift the nose up. It came up very quickly and instantly we were going up at a shocking angle and rate of climb. The minute we were off, he started making a series of 90 degrees right and left turns. After a pass of the field, Burt announced he would demonstrate "departure stalls" (one can hear conversation very well, even though tandem). Thereupon he hauled up the nose in a steep left climbing turn, held it awhile, then stated, "OK, there it is." He then executed beautiful right and left steep banks and directional changes, all the while when it was technically "stalled". Actually we were still seeming to climb about 500fpm and things never felt the least bit "loose".

Burt cranked into the downwind, aiming approximately at the cross on mount Rubidoux, approached the cross, CAME RIGHT UP TO THE CROSS ABOUT ONE INCH AWAY, and casually flicked into an instant left bank like a bored housefly in July. If I'd tried that in my Mooney, crews would have been picking up pieces scattered a mile East of the mountain, and I'd have been crucified. It's really strange though. I have a very healthy respect for flight, and what a plane can and can't (or shouldn't) do, yet not ONCE was I ever the least bit anxious, uneasy, or apprehensive. The VariViggen has a solid feel of confidence and safety throughout the entire flight regime. It is really the finest maneuvering craft I've ever had the pleasure to ride in, and at all times you REALLY KNOW IT'S FLYING. Landing was so apparently simple as to be nearly anti-climactic. Burt had saved another few surprises for the ground, though. Naturally, he had landed super-short, and said, "OK, watch this. We'll go taxiing right between those parked birds.", pointing to a pair of high wingers moored practically tip to tip, with ropes coming down at 45 degree angles and meeting about 6 feet apart. "Have you really thought seriously and adequately about this

decision?", I say, as he goes chugging merrily through like he was only pushing a wheelbarrow. I sweat a bit finally that time, as I pictured three airplanes suddenly hugging each other in a big MUNCH! The ground handling is fantastic, as it can, I believe, turn in its own length and width, or bring its nose up touching a building, then turn left or right and taxi away without bumping a wing. (No reverse needed). People -- things are happening in EAA. Thanks, Burt."

VVN4, Page 1

CONSTRUCTION MANUAL - Part one of the photo-illustrated construction manual, written by Jim Cavis, SN 31, with approximately 100 photos, is just about completed (includes fuselage, canard, inboard wing, vertical stabs, control system, and landing gear). Part one also includes helpful sketches on jigs and numerous building tips. The written information is similar to plans chapter 5, except expanded to about 35 pages. Also included are pulley bracket drawings for using of the AN220-2 pulleys. Part one will be ready June 15th. Cost is $18.50 (first class mail) and $20.50 for Overseas (Airmail).

SPECIAL PERFORMANCE WING - The SP wing configuration still looks very similar to that shown in newsletter number 3, but I've greatly simplified the construction method and upped the wing fuel capacity to nine gallons per wing. The construction method was verified on the fiberglass VariEze wing, which was built in two days. We have completed all necessary structural static tests, thermal tests, and fuel compatibility tests. I'm now awaiting another shipment of unidirectional fiberglass to build the flight item SP wings and hope to have sufficient flight test data by mid June to show the acceptability of the new wing.

ADHESIVES - Gougeon Brothers, 706 Martin St., Bay City, Mi 48706, whom we mentioned in newsletter number 3 as having an excellent epoxy glue for wood (105 Resin plus 206 Hardener at $25/gallon), now has a mini pump system which attaches to the cans and dispenses the correct ratio (5 to 1). Each stroke of the resin pump gives 1 oz.; each stroke of the hardener pump gives 1/5 oz. Good news is the price: $3.50 for both pumps. Get two sets; they're plastic and may have a limited life. Gougeon 105/206 still looks like the best resin, although Aerobond 2178 is also excellent (available from Aircraft Materials, 850 E. San Carlos Ave., San Carlos, Ca 94070).

BUILDER'S PROJECT REPORTS - The following reports/photos were sent in by builders and I agree with the building hints suggested. You might consider them for your project.

Charles Allen (SN 47) on fuel tank -"The tank was made this way mainly because I had on hand a sheet of 6061 .050 alum., which is a weldable alloy, but of course harder and springier than 5052 - I drew up the two end bulkheads on paper using rounded bends but straight sections in between - Cut the two body pieces at least 1" longer than needed, then bent the "rounded" corners on a friend's sheet metal brake. A series of slight bends is all that is needed, frequently holding the piece over the full-size end patterns to check accurate progress. A right angle flange is bent where the top and bottom pieces join. The two pieces are then joined by about 3 clecoes on each side on the inside

flanges. Then the exact cut-off line on each end are drawn on the tank - and the tank is trimmed - I used a table saw, a plywood blade, and a lot of cotton in my ears. And of course safety glasses at all times! Each tank end is then set on the alum. sheet to be used for the end piece and traced. The ends are cut out allowing at least 1/2 - 3/4" for a bent flange all around. Saw cuts are made into the corner areas. The good thing about this is a form block for each end is not necessary - Just a 2x4, or 6, clamped along the straight sections and those sections bent over. The small tabs are bent over a small block. The ends are clecoed onto the tank body. First the .032 baffle is made, put in place. Also the holes for the filler neck, tank gauge and vents and bottom fittings are drilled - I do not flange those holes - Welding the fittings directly to the tank is adequate. The whole thing is then taken to a good heli-arc welder - I left the tank gauge hole open - checked for leaks and then used sloshing compound on the inside to make sure - The tank gauge was bolted to .063 alum. plate which was then riveted to the top of the tank using closed-end pop rivets - Sealing compound was put on between tank and plate first - Tank was then primed with zinc chromate and painted - Sounds complicated - but it really is not." **SKETCH OMITTED**

Vernon Williams (SN 189) on reflex screw (RM5/RM6) - "The reflex screw is from a 5" craftsman "C" clamp. It is a 5/8 - 8 acme thread. I cut the neck off the clamp and turned it to fit inside a 3/4" tube. The whole tube assembly is brazed onto the gear of the motor (Ford unit) which has been turned down to fit inside the tube... When turning the drive gear down on one of these motors some precautions are needed because the teeth of the drive gears are hardened and will eat a common tool bit right up. First grind the teeth down to near the base diameter of the gear. Then, you can chuck the drive gear directly in a three jaw chuck and by using a fast turning speed and carbide cutter you can turn the rest of the gear down."

Vernon Williams on inboard wing spar - "The key to this method of construction is to build spar E first. I built mine complete out to FS 25. In building the spar, make your wing ribs first and take the measurements for the spar height from your actual ribs and not from the plans. This is necessary because the drawing shows the height at FS 153 which is in the middle of the spar. Also at least one of the dimensions given is off at least 1/2"* ... I made a stub (about 12") WR25 to use as a spacer and have made the WS9 and WS10 webs. I plan to drill all the holes to mount the wing attach fittings, main gear pulley, and the aft gear pivot point before I even mount the spar on the firewall. The main advantage I see is that when you mount the spar on the firewall (be sure and support it or the weight will pull the firewall down) it gives a nice straight, level, and strong datum to build the wing from. Also, the spar can be out where you can drill the important holes in a drill press. In assembling the whole mess, the WR25 can be slid in and turned up to fit in place and the WS9 and WS10 webs can then be glued in place (the wing attach fittings can be used as clamps) and then the rest of the ribs can be added ... Instead of trying to bend WS1, I made it straight and then bent the WS3 and WS4 caps to form the curve of the spar. Then I set my bandsaw to cut the 4 degrees bevel and trimmed the height slightly oversize. Then I got out my trusty Jack Plane and planed it to size. This makes a nice looking spar which should (I hope) make building the wing easier." * Be sure

to note the correction on the spar height at B.L.=0 (7.8 dimension should be 7.3).

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

N27VV and the Monster Car Filming "Death Race 2000"

Model Being Set Up for Crash Scene

Carolyn with the Monster Car Driven by David Carradine In "Death Race 2000"

Orville Winfield, SN 114, Fuselage and Canard

Charles Allen's Tank in Place

Mike Melville's Nosegear Motor

Mike Melville's Main Gear

Charles Allen's Tank

Vernon William's Spar E

Vernon William's Reflex Screwjack

Mike Melville's Maingear Motor View from Underneath, Looking Aft

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PLAN'S CHANGES - Be sure to incorporate these revisions into your plans now.

Location	PL	Plans
	TR	Tech Report
	NL	Previous Newsletters
	CAT	Catalog
Category	MEO	Minor error or omission
	OPT	Optional improvement
	DES	Desirous change - Does not effect flight safety but should be incorporated to improve aircraft or correct a fault
	MAN	Mandatory change - Must be incorporated as safety of flight is affected

CATEGORY	LOCATION	CHANGE
DES	PL pg 59	NG38, change 1/16 to 3/32 cable.
OPT	PL pg 40	AB4, move cable shackles 1/2" closer to pivot (change 5.5 to 5.0) to allow sufficient cable clearance with MG6.
MEO	NL#3 pg 7	Change Aero T50 to Arrow T50.
MEO	PL pg 51	MG42, spool 0.5" width should be 5/8" to

		allow sufficient cable room. Change 1/16" roll pin to 3/32".
MEO	PL pg 24	7.8" dimension on Spar E should be 7.3".
OPT	PL pg 39	Tilt the lower edge of PB2 rearward about 1/2" to allow more cable clearance with SA6.
MEO	PL pg 46	NG1, .5" should be .6". .85" should be .95".
DES	PL pg 38	SA5 has inadequate lateral stiffness. Stiffen by welding 3 pieces to top rim as shown: **SKETCH OMITTED**
DES	PL pg 44	Engine position is shown on the plans only by locations of the mount pads on the engine mount drawing. To obtain more prop clearance and the correct fit to the cowling, the crankshaft at the prop flange should be located at W.L.32 (prop flange at F.S.186.5). For conical mounts (not dynafocal) the top mounts should be at W.L.36.2 and the bottom mounts at W.L.26.55. More details on this are shown on the instructions included with cowlings. Delete the F.S.189 circle on PL pg 6. Add a 12" circle with center at W.L. 32. Lable it F.S.186.5.
OPT	PL pg 39	PE2, change 1.3 to 2.0 and change 1.8 to 2.5. This moves cable forward to provide extra clearance with MG43 gears. (May not be required - depends on your MG43 installation.
MEO	PL pg 28	VS1, 2.8 dim. should be 2.5.
MEO	PL pg 17	A fairlead should be installed at B.L.4.3 and W.L.6.3 on F51 to position the rudder cable below F21.
MEO	PL pg 45	Turnbuckle required on 1/16" cable that runs gear up & down cannot be a standard turnbuckle since they use up too much cable room and would run up on either pulley. Total disturbed cable length must be less than 4 1/2" including nicropress sleeves. N27VV has a short homemade turnbuckle made from 2 shackles and a short length of threaded alum tubing. Another method is to eliminate the turnbuckle and adjust tension with a small idler pulley. Vernon Williams substituted a chain as suggested on the plans and he reports excellent results with a Boston K2512 pulley and No. 25 chain.

LANDING GEAR RETRACTION GEARING

We are recommending mandatory changes to increase the retraction/ extension forces on the landing gear . These new gearing changes will allow use of either the Dodge or Ford window motors and will result in positive gear retraction for all allowable aerodynamic conditions . NOSEGEAR - The system shown on the plans is inadequate for inflight retraction loads with the nosegear door installed, particularly when using the Ford window motor. It is necessary to gear the motor similar

to the maingear motor installation to provide adequate retraction torque. Ratio required is between 3:1 and 5:1. The following gears, available from Boston gears (check your local Yellow Pages), will work well:

Boston No.	P. Dia	Hole	Price (1971 Catalog)	
NA11B	0.6	5/16	$1.95	Mount to motor
NA50	2.5	3.8	$7.50	Mount on NG6

Be sure to test the power of your retraction by pulling 15 lb aft at the nosewheel with a fish scale while the gear is being retracted. The following quote and photo from Mike Melville further clarifies the installation:

"I am delighted to report that my nose gear retracts effortlessly in about 10 seconds even with a constant 15 lb aft pull. Pulling the pin and swinging the gearmotor away from the gear allows the nosegear to freefall down and lock. It works perfectly and I could not be more pleased. Also, when I lowered the gear ratio, I did not move the spool NG1, but I lowered the gear motor downward until the small gear engaged the bottom of the large gear. This worked out well, as nothing now protrudes up into the canard."

I understand it is possible to find a gear which will mesh directly with the gear provided on the Ford or Dodge unit. This eliminates the need to adapt a small gear to the motor. Don't ask where to find this gear though, as I have no source and those who have found one scrounged them at surplus outlets.

MAIN GEAR - Plans call out a 1:4 reduction for MG43 gears. This should be increased to between 1:6 and 1:9. The following Boston gears will fit and work well, providing a 7.3 ratio:

Boston No.	P. Dia	Hole	1971 Price	
NA11B	0.6	5/16	$1.95	Mount to motor
NA80	4.0	1/2	$9.40	Mount on MG41

NB series gears can be substituted for the NA series on either nose or main gears. The following quote and photo further clarifies Mike Melville's excellent installation: (Photo on page 3)

"The view of the motor assy shows it temporarily clamped in position with 2 "C" clamps. I used a 12-tooth gear on the motor and 97-tooth gear on MG41. It retracts in 12 seconds and is not affected at all by pulling 10 lb outward on each gear (during retraction). My wife says I am like a kid with a new toy!! I have not had the courage to drop the main gear all the way from the top (emergency extension system) as I am afraid it will break something! It is probable that my MG6's will snap solid into place (down lock) when I do let it freefall. I will try this after I get the bottom skin on."

As I remember, I waited to skin the bottom also, before testing the emergency freefall system. MG6 (MG5 Lugs) have always snapped into the locked position during emergency freefall testing. Depending on your

gear motor and gears selected, you may have to modify the shaft in the gear motor and provide a shaft bearing on the outside of the gear. The following sketch shows Mike Melville's modification: **SKETCH OMITTED**

Of course, if gears are available which would mesh directly with the gear on the Ford or Dodge motors and provide 4:1 ratio for nose gear and 8:1 ratio for main gear, the installation would be greatly simplified. If anyone knows of a source of these size gears, let RAF know and we will print it in a future newsletter.

MAIN GEAR DOWNLOCK ADJUSTMENT

The plans do not show any adjustment on the snubbing of the gear in the downlocked position. I have noticed a slight amount of freeplay in N27VV's right gear after 400 hours that is not serious enough to require attention but I am recommending that you include an adjustable wedge that can slide sideways to provide downlock snub adjustment. The MG4 beams sold by RAF were machined shorter than the plans due to an error, but these will now fit well when used with the downlock adjustment. If you are making your own MG4 beams, make them approximately 1/4" short on the end so they will fit with the downlock adjustment. To provide the best downlock geometry with the adjustment installed and the shorter MG4 beams, move the pivot for the MG5 lugs outward (toward the wing tips) about .15" to B.L.34.15. This move is not absolutely required, though, if you have already located the pivot at B.L.34, the downlock will function with a thicker wedge on the downlock adjustment, and the gear total motion to the extended position will be closer to 92 degrees than the 97 degrees shown on the plans and the main gear extended position will be inboard of the B.L.40 position shown in the plans and should result in more even tire wear than on N27VV (I now have to reverse the tires during the wear cycle since they wear more on the inboard side). The sketches show the geometry of the downlock adjustment and the new position of MG4 and MG5 in the locked condition. **SKETCHES OMITTED**

BUILDING TIPS

You don't need to weld the caps on NG13 with the nutplates riveted inside. You can drill two 5/8" holes on the front or back near the ends and install the nutplates, or a locknut, after welding.

The following are the Lycoming-listed dry weights for the engines recommended for VariViggens: 0-235-242 lb, 0-320-273 lb, I0320-292 lb, and 0-360-285 lb.

Vernon Williams has ordered a ground-adjustable wood prop from Bernhard Warnke, Box 50762, Tucson, Az. 85705. This appears to be a good way to have the safety and light weight of a wood prop and also have the flexibility of the adjustable feature. (See March 75, "Sport Aviation" for article.) We are presently working with Sensenich in the development of a wood prop for VariViggens that is similar to the wood props they developed about two years ago for the Thorp T-18 homebuilt. More details after flight testing when this one is available.

The Fafnir number for the 5/16" belcrank bearing is BC5W11.

The following sketch shows the position of the skin scarf joints on the fuselage and inboard wing of N27VV. 50"x50" birch plywood was used.

Grain was 'forward-aft' except for the large piece on the inboard wing which is parallel to the leading edge. **SKETCH OMITTED**

SHOPPING - The following companies have excellent spruce kits for the VariViggen. They include all spruce cut to the sizes shown on plans page 4. I can vouch for their excellent quality. Write them for prices and availability. Aircraft Spruce and Specialty, Box 424, Fullerton, Ca 92632; Aircraft Materials Co., 850 E. San Carlos Ave., San Carlos, Ca 94070.

Some builders have had problems locating the very important decimal steel tape measure, suggested in Newsletter #1. Bill Riddell (SN 50) reports that he has access to a large number of the 61-112 rulers and any builder can send him a check for $6.50 which includes postage and he will send a ruler. Bill Riddell, 4575 Shadesview Dr., Pensacola, Fl 32504.

Lloyd Toll, Box 303, Hazen, Ar 72064 does excellent alum welding and is equipped to build fuel tanks for VariViggens. He has a lot of fuel tank experience. Write him for quote.

The following company has a stock of aluminum at 1970 prices, 50cents/lb!: McGowan Company, Inc., 560 E. Maitland, Ontario, Ca.

NEW PRODUCTS FROM RAF

Add the following items to your RAF Catalog. Prices and availability as indicated.

V-CSP - We have a limited number (5 ship sets) of the LS-806 pulleys in stock now. These are the 2-bearing pulley used in the primary control system (10 places) and fit the brackets drawn in the plans. They are new and equal or better quality than the best AN220 pulley. Price is $3.75 each if picked up here. Add 25 cents for each pulley ordered to cover packaging and postal/UPS shipping charge if you want them shipped.

V-INRIBS - This is a package of birch plywood pieces with all the inboard wing ribs (except WR46) drawn on them (full size of course!). The homebuilder saws along the lines with a saber saw or band saw to fabricate the ribs (eliminates scaling up plans). A 2-inch overlap is drawn on the longer ribs for the homebuilder to scarf together. Price $78.00. Availability JUN 20. Add $5 for packaging if not picked up at RAF. Shipped freight collect.

V-BKHDS - This is a package of birch plywood pieces with F20, F32, F41, F51, F63, F70, F91, F103, F111, F121, F137, and F152 drawn on them. Eliminates scaling up the plans; builder cuts along lines to fabricate bulkheads. Price $169.00. Availability JUN 5. Add $5 for packaging if not picked up at RAF. Shipped freight collect. This package also includes WR46 inboard wing ribs. 3/8" ply is marine fir AA grade.

V-CMAN1 - VariViggen Construction Manual (part 1) - See description elsewhere in this newsletter. Availability, 15 June '75. Price $18.50 including first class mail, or $20.50 for air mail Overseas.

VARIVIGGEN COMPONENTS

All machined parts are in stock in adequate supply except V-WAA which we are down to two ship sets and it will be about six weeks until we get more. We can sell the eight tapered pins separately if you want to fabricate your own straps and buy the heat-treated, cad-plated taper pins. Note that they are tapered 3/4" per foot rather than the taper shown in the plans. Thus, a standard pipe taper reamer can be used to taper your straps (before heat treat of course!). Price for the eight pins alone is $37.00 including packaging.

Some builders have asked why NGSA is so expensive. The following is a list of the operations required to build it, which gives you an idea of why the cost is so high: Cut three 4130 steel tubes to length and face ends, machine plug to close tolerance for shrink fit in tube, shrink fit plug and tube, fabricate 'U'-shaped part which fits the Scott assembly, weld assembly of five parts (weld backs up the shrink fit to assure no leakage), heat treat, grind strut, hard chrome, re-grind strut, mask strut, cadplate lower end, bake assembly for surface embrittlement. I've had the entire nosegear assembly from the parts in the first 25 ship sets on N27VV for the last 50 flight hours and have had no problems at all with any of the parts.

Do not order backup rings for the nosegear installation. The strut is designed as a low pressure assembly and provides excellent sealing with the o-ring alone with no requirement for backup rings. We will still supply the O-ring set and scraper to complete the nosegear assembly. If you are building your own nosegear parts, machine the o-ring groove to fit the o-ring only and do not use backup rings.

Installation instructions are included with all RAF-supplied machined parts.

All fiberglass parts have been in stock since March 5th. Installation instructions included with all fiberglass parts include drawings detailing the installation of landing light, all doors, engine cooling baffling, engine induction system, exhaust system, cowling exhaust shields, carb-heat system cabin heat system. Note that unlike conventional baffling, VariViggen cowling installation results in the magnetos and fuel pump running in cold air rather than air heated by the engine cylinders. This extends magneto life and eliminates vapor lock.

Instead of my description of fiberglass parts, I'm including a quote from a letter from Mike Melville (SN 115).

"What can I say, Wow! Much to my delight, my fiberglass parts arrived today, in perfect condition and beautifully packed. The shipping charge was very reasonable and the quality of the parts is outa-sight!! I could not be more pleased. I expected them to be good, but this is really professional quality. Just super! I also received my "Flying" magazine and was pleased to see the article about the Viggen. I think it is an excellent article and the photos are great. The new cowling

looks good in the last photo. I love mine, the finish is unbelievable. The instructions are worth their weight in gold as well."

The new nosecone design eliminates the F26 metal ring by providing a joggle which allows bonding the plexiglass dome on flush without a ridge on the outside.

Our packaging cost for the set of all fiberglass parts is $20.00. If you pick up these parts here at the Mojave Airport you can save $20.00.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Exhaust System. Note squashed ends and multiple lower outlet holes. Complete exhaust system installation instructions are supplied with cowlings.

RAF-Supplied Machined Parts

RAF-Supplied Nose Cone on Jim Canis's Fuselage

F27 - Visor

New Cowling from Front

RAF-Supplied F28. Note air outlet and recess for fuel servicing door.

New Cowling from Rear

VARIEZE

The VariEze, a prototype aircraft built at RAF since Newsletter #3, is nearing completion. First flight should be before June 1st. This aircraft is being built as a research project to evaluate the feasibility of a high-aspect ratio (eleven, on wing and canard) canard configuration for optimum cruise performance. This aircraft may be offered in plans and kit form if it proves to have good flying qualities and safety and when we have completed all flight tests, including spin, flutter, environmental, and reliability tests. In the mean time, we hope to use it to capture most of the important speed and distance records in the under 500 kg weight class. Releasable specs are shown in the following. Please don't ask us for any more information than is shown here as all other information must be withheld pending completion of the appropriate development and testing. When it's available, further information will be in "Sport Aviation" magazine and in "VariViggen News."

Construction - Fiberglass/Foam composite, no structural wood or metal
Wing Area - 49 Square Feet Wing Span - 24 Ft
Canard Area - 14 Square Feet Canard Span - 12 ft
Gross Weight - 870 lb
Empty Weight - 380 lb (VFR)
Two-Place Wing Loading 13.8 PSF
Pwr - Volkswagen or Franklin 60 Direct drive, prop mounted on

engine
Elevons on canard, no control surfaces on wing
Fixed main gear - airfoil-shaped, molded fiberglass strut.
Retractable nose gear - ball/screw assembly allows retraction/extension on the ground with crew in the airplane. Thus, the airplane "kneels" and parks on its nose.
Directional stability provided by Whitcomb 'winglets' with single-action rudder/speedbrake surfaces.
Only about 25% of the number of parts as in a conventional structure/configuration. Structural method allows maintenance of exact surface contour for even severe flight loads.
Flight surfaces are being contoured to within .003" per 2" surface waviness.
All performance estimates are being withheld - I refuse to claim estimates that I myself don't believe, and since this is now just a research project, I cannot answer any questions pertaining to it. Sorry.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

VariEze Wind-Tunnel Model

VariEze Prototype. Butt's dad, George, is holding wing.

VariEze Prototype in Front of RAF Headquarters.

Jerry Stewart received this letter and sketch from a friend:

"Dear Jerry, Have uncovered an obvious mistake in the design of the sportplane you are building. The rudders are supposed to be attached to the elevators - not the wings. (The designer was celebrating April first when he drew the plans.) Shifting the rudders to the rear (as shown) will also greatly improve forward visibility and will keep the plane from spinning wildly during flight. If you're in doubt about which way it goes - I suggest you start from the middle of the runway when you start your take-off run. Above all - remember to land just before the fuel gauge reaches full. (If the same guy designed your parachute, - you're in real trouble!)" **SKETCH OMITTED**

FLASH! World's first VariViggen gear-up landing.

The newsletter was held up to include the details of my first gear-up landing. It occurred during the air-show at the Corona regional EAA Flyin, May 4. N27VV gave airshow demonstrations on Saturday and Sunday for the flyin. On Sunday, I had completed the airshow demo, all except the landing; when I moved the gear handle down, I heard a different noise and noted that although I had electrical power to the main gear (transit light on) the mains did not come down. The failure was later determined to be the spring that connects to MG24 uplock arm. The spring had apparently been knicked with pliers when forming the hook on one end in 1970 when the spring was installed. Five years later, during the airshow demo, the spring broke. Without this spring, the

right main gear remained locked up. After several passes over the crowd, for inspection of gear position and some radio discussion with those on the ground on whether or not to land in an adjacent grass field, I decided to land on the main hard surface runway with the nose gear down. This was taking the risk that the nose gear would not fail and thus reduce the damage. I made a "full-stall"-type landing with engine and switches off and after a short roll/slide, I got out to inspect the damage. Damage was limited to one skid (VS1 extension with small wheel) a small scrape on one wing tip -(only one rivet damaged) and partial collapse of my centerline fuel tank. The tank remained attached firmly on its mount and did not leak. The nose gear took the 'slap down' load well with no damage. About 20 volunteers lifted the aircraft up while I scampered underneath to manually free the uplock and to lock the gear down. I then taxied back to a hangar, inspected the aircraft, elected to pin the main gear down and locked for the flight home and within 1 1/2 hours of the gear-up landing, I took off and flew it back to Mojave where I was greeted by 60-knot surface winds. Landing and taxi-in were uneventful despite the fact that at the time, two other aircraft were being jerked from their tiedowns and suffered wind damage much greater than my earlier gear-up landing!

I learned a bit from this experience:

1. Inspect uplocks during preflight and use appropriate quality control during their installation.

2. If faced with a main gear-up landing, pull the main gear circuit breaker, extend the nose gear and make a landing with the nose quite high (full flare) on a hard surface. This landing is really not more difficult than a conventional landing and you can expect very little damage.

3. Gear-up landings on VariViggens are far safer than on conventional aircraft where one of the first things to get damaged is the carb and fuel line and the possibility of a fire exists.

4. Note that the emergency extension free-fall system backs up an electrical failure and a mechanical failure of the electrical motor and gear box, but does not extend the gear with a jammed uplock. I do not recommend a design change of any type since the gear has had nearly 1000 satisfactory cycles during all types of weather and flight conditions. Any change now would be starting at zero experience with a resulting increase in risk.

5. Gearup landings have a very positive appeal from a marketing standpoint. It emphasizes how rugged the structure is (to survive with only minor damage) since we immediately received seven orders for plans from people who saw the landing!

VARIVIGGEN NEWS No. 5 July 75
PUBLISHED QUARTERLY
JAN, APL, JLY, OCT by

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SKETCH OMITTED

THIS NEWSLETTER is being written in the last few days of hustling around, completing all the preparations for Oshkosh '75. The last few months we have really been busy with our new airplane's first flight only eight weeks ago and the new SP wings for the VariViggen being flown only a week ago. So, I hope you excuse us if the newsletter is a little short and somewhat disorganized.

We need a name for the newsletter! Now that the newsletter is being expanded to include the VariEze as well as VariViggen, our old name is no longer good. Please send in your suggestions, possibly a name using the word canard?

VARIVIGGEN SPECIAL PERFORMANCE WINGS

The new all-glass special performance wings for the VariViggen (see Newsletter #3) were flown for the first time on July 16. The performance improvement has been as expected: rate of climb at sea level, 1600-lb weight, is just over 1000 fpm! For rate of climb at altitude, add about 150 fpm to the curve shown in the VariViggen Technical Report. Cruise performance is higher, also. With the new wings and the new RAF-supplied cowling, the cruise speed at 8000 feet is 159 mph using the 0-320 engine at 75% power. The SP wings were flown both clean and with winglets. The winglets add directional stability, help the rate of climb at low speeds, and have no effect on the cruise speed.

What are winglets? Winglets are two vertical fins on each wing tip. They were designed by Dr. Whitcomb from NASA who previously developed the transonic area rule principle and the supercritical and GA(W) airfoils. VariEze, N7EZ, was the first aircraft to fly with winglets although hundreds of hours of windtunnel tests were previously conducted by NASA. The lower surface winglet extends from the leading edge back to 33% of the tip chord. This surface is cambered inward and is inclined 30 degrees out from vertical. The upper surface winglet extends from 33% of the tip chord aft. This surface is cambered

outward and is inclined 15 degrees out from vertical. Winglets are optimized to unwind the tip vortex to the greatest extent possible. This reduces induced drag, resulting in a 6% fuel saving. In addition, the local incidence of the surfaces are inclined to produce forward thrust which offsets the parasite drag of the vertical fins. This is possible due to the high amount of lateral flow near a wing tip. **SKETCH OMITTED**

The SP wings hold 18 gal of aux fuel, which increases max range to near 600 miles. This fuel is pumped into the normal fuselage tank by an electric pump. The tanks have flush caps and are filled individually. The weight of the new wings are about the same as the old, metal wings. The tiedown points have been moved to near the tip to allow more convenient attachment of the most common tiedown systems.

The SP wings use the same WA3 straps which are used on the metal wings. These bolt to a stub wood spar which is only two ft long. The rest of the spar is unidirectional fiberglass. The entire skin, trailing edge spar, and ailerons are glass/foam composite. No ribs are used. The SP wings were built in about 110 man-hours which is only 1/3 the time needed for the aluminum wings. Finishing time to obtain a first-class surface contour added about 30 man-hours.

A large number of photos were taken during the new wing construction for use in the SP wing plans. The plans will also show many details to educate the builder in the methods of structural fiberglass application. The plans will also include drawings of a foam/glass rudder. Thus, all the sheet-metal structure will be removed from the aircraft.

Flight tests have shown only a one-mph cruise speed change with reflex position, thus reflex control probably will not be required for a VariViggen with SP wings. I need to do more flight testing with the new wings before I decide on this for sure, but it looks as though we may recommend a fixed reflex and lengthening the nose gear about 2" to allow a slower nosewheel lift-off speed without the aid of up reflex. Rate of climb does not seem to change with reflex position when using the SP wing. All modifications required and details will be included with the plans. The wings will be "service tested" on the Oshkosh trip. We will start work on the construction drawings when we return. I expect plans availability by October.

We do not plan to stock the foam, since it is readily available from other suppliers. We will have the unidirectional fiberglass though, since it is not readily available in partial rolls. We will not stock the Shell epon epoxy resin, but we will refer you to several retail suppliers.

MORE ON WOOD ADHESIVES - I have received two separate reports from builders who have had poor results from the epibond resin recommended in the plans. Apparently the supplier has been sending out resin which is out of shelf-life or otherwise unsatisfactory. Until this is resolved, I recommend the use of only the epoxies shown in previous newsletters, rather than epibond.

VARIVIGGEN PLANS CHANGES - I can't really believe it, but since newsletter #4, I have received no notices of errors or improvements in the plans! Is everyone asleep or have we finally weeded out most of the corrections? There are important plans changes in the last four newsletters. VariViggen builders who do not have these, should purchase the back issues ($1 each; no charge for Newsletter # 1).

VARIVIGGEN FUEL TANKS AND ENGINE MOUNTS - Vernon Williams (s/n 189) has made five fuselage fuel tanks and will have them on display and for sale ($175.) at Oshkosh. The tanks are excellent quality and include the filler neck and finger strainer. He has also produced dynafocal-type engine mount for his VariViggen and may be talked into making one for yours. Contact him directly - #4 Southmont Circle, Little Rock, Ar 72209.

VARIVIGGEN KICK-IN STEP - VariViggen prototype, N27VV, has been equipped with a kick-in step to allow front cockpit boarding without the ladder. This was a relatively simple modification requiring only about three man-hours. The following sketch is self-explanatory. The shorter-legged pilot may want to move the step up about three inches to easily allow his leg to swing over the side. **SKETCHES OMITTED**

VARIVIGGEN INBOARD WING RIBS AND BULKHEAD KITS - Our apology to those who ordered these items at the availability date noted in Newsletter 4 and then waited over six weeks for delivery. Our supplier was unable to meet his initial estimate and when the first kits were inspected, several changes were required. All back orders should have been shipped by 22 July. The bulkhead kits also include F5, F7, F8, F9, and F18 pieces, as well as excess plywood.

VARIVIGGEN CONSTRUCTION MANUAL - Part One of the construction manual has been in stock since June 26. The manual with its many photos is proving to be very beneficial, particularly to the first-time builder. Part One does include landing gear construction, but is not as detailed in this area as it should be. More landing gear construction information will be included in Part Two. The construction manual will not cover the outboard wings, since these will be well photo documented and the procedure will be detailed in the SP wing plans.

NEW PRODUCTS AVAILABLE FROM RAF -

VariEze Information Kit - includes approximately 4000-word description, 14 photos, and one 8"x10" glossy, all specifications, performance charts, homebuilt program, etc. $5. - includes first class mail ($6.00 Overseas).

VariEze Embroidered Jacket Patch - Tri-colored; VariEze planform - $1.95 each.

BUILDING TIPS - If your wood pieces do not fit perfectly for gluing, merely mix asbestos fibers (available from Gougeon Brothers, 706 Martin St., Bay City, Mi 48706) in to thicken the epoxy, so it will not run out of the gap. Structural joints can be made with gaps as great as 1/16" and non-structural "fill-ins" can be done up to 1/2".

SHOPPING - Partz Corp., 1232 W. Main, Owosso, Mi 48867, (517) 725-8565 will anodize approximately 100 small alum. fittings for $15.00. Suggest certified mail, return receipt requested, if you mail your parts to them.

LOOK FOR ANOTHER VARIVIGGEN ARTICLE in "Science and Mechanics" magazine - on the newsstand after September 30.

The following is the schedule of forums at Oshkosh '75 by Burt Rutan:

Design Forum - Friday
VariEze - Saturday
VariViggen - Sunday

VARIEZE COMPLETES 95-HR FLYING -
TO BE OFFERED AS A HOMEBUILT IN 1976

The VariEze prototype, N7EZ, has been logging a lot of flight time for such a new prototype. It made its first flight on 21 May 75 (almost exactly three years after the VariViggen prototype). The initial test program was completed on 8 July and the area restrictions were lifted. Since then it has been flown to the Hollister fly-in here in California, and on a 1000-mile round trip to Tucson, Arizona.

The back seat has been fitted with a temporary long-range fuel tank for the distance record attempts. Dick Rutan, Burt's brother, plans to fly N7EZ nonstop from Mojave, Ca to Oshkosh, Wi on 1 Aug 75. Then, within the next week, an official FAI/NAA closed-course distance record attempt will be made. Look for an article and the VariEze on the cover of the September issue of "Air Progress."

The VariEze was designed for maximum cruise economy. It can demonstrate 70 mi/gal with 30% power at 135 mph; at maximum cruise speed with 75% power, 48 mi/gal can be obtained at 185 mph. Climb performance for the Volkswagen-powered two place is 1200 fpm at 880-lb gross weight (two people, 1000-mi range), and 1800 fpm at single-place weight of 625 lb. The aircraft can carry two 6-ft, 4-in people and two specially designed suitcases.

The name, VariEze (pronounced, "Very easy"), refers to the aircraft's ease of construction: The prototype was built entirely from fiberglass in composite form using rigid foam as core material, and simplicity was the key in structural/system design.

This fall, the VariEze prototype will be making assaults on the following FAI World Records in the under 500-kg (1102-lb) weight class:

RECORD	NOW HELD BY	CURRENT RECORD	ESTIMATED VARIEZE CAPABILITY
Distance In A Straight Line	Kaarlo Heinonen Finland HK-1	1767 Mi	4400 Mi
Distance	Ed Lesher		

In A Closed Circuit	USA Teal	1554 Mi	4400 Mi
Speed For 2000 km Circuit	Ed Lesher USA Teal	142 mph	185 mph
Speed For 1000 km Circuit	Ed Lesher USA Teal	169 mph	235 mph (Turbo Charged)

Several changes were made during the initial test program. The pitching moment of the main wing was too great, which transferred too much load to the canard. This was temporarily corrected with metal tabs taped to the wing trailing edge and later permanently corrected by a change in the main wing airfoil. The original canard configuration may have been susceptible to flutter. A modified canard with distributed, overbalance weights has corrected this. The canard uses the GA(W) airfoil which has not performed as well as had been expected. Its chord is only 14 inches, thus at stall, the Reynolds Number is only 500,000. The GA(W) airfoil has very poor lift below 750,000 Reynolds number. This results in a higher than desired stall speed (55 to 60 kt) and poor roll rate below 70 kt. I have located data for an airfoil designed for high lift at the low Reynolds number. After Oshkosh I plan to build another canard for N7EZ using this new airfoil. It will have a low trailing edge camber, thus the external trim tabs will not be required.

We plan to market construction drawings and components for the VariEze in the spring of 1976. Tooling will be constructed this winter for the production of homebuilt components (canopy, cowling, forward seat/bulkhead, main wing spars and centersection spar, molded glass landing gear, and machined parts). The first parts from the tooling will be used to build another VariEze here at RAF. This will absolutely prove the tooling accuracy. This construction project will be photo documented and those photos will be used in the construction plans.

We have received very few builder's suggestions since Newsletter 4. If you have found a "better way" to do something, let us know and we'll pass it on to other builders. Also, if you have questions about the VariEze which are not in the information package or here, send them in and we will answer them in the next newsletter.

NEWSLETTER RENEWAL - When your newsletter subscription has expired, a notice will be placed in with your last issue.

SEE YOU AT OSHKOSH!

SKETCHES AND PHOTOS OF VARIEZE OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dynafocal engine mount by Vernon Williams

Fuel tank by Vernon Williams

SP wing on N27VV

THE CANARD PUSHER NO. 6 OCT 75

NEWS OF THE VARIVIGGEN & VARIEZE PROGRAMS
PUBLISHED QUARTERLY
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Art Work by Gary Morris

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SKETCHES OF VARIEZE AND VARIVIGGEN OMITTED

THE NEWSLETTER NAME, formerly "VariViggen News," has now changed. The suggestion of "Tail Pusher" was sent in and we modified it to "Canard Pusher." A special thanks to that person, whose name we don't have, and who gave us the idea. Ken Ashdown's suggestion of "Canard Line" ran a close second to being picked for the newsletter name. We received many, good suggestions - thanks to all who contributed. The following list are a few of those which we thought would make interesting reading: The Canard Line, The Canardian Club, Vari New-Z, Canard Time News, The Vari Forum, VariUnique Aircraft News, Canard Capers, Canard Contrails, Glass Backwards News, Vari Vignette, The Canard Rumor, Canard Disclosure, Canard Gas Line, Canard Trend, Canard Courier, The Backward Flyer, The Canard Leader, On the Nose, Canard Tales, Canard Forward. The new name should last for some time now, until we come up with an aircraft without a canard!

RAF ACTIVITY has been brisk since the July newsletter. More tests have been completed on the new SP wings for the VariViggen. Carolyn and I flew the VariViggen to Oshkosh, including a trip to Kentucky on the way back to California. My brother, Air Force Lt/Col Dick Rutan, flew the VariEze to Oshkosh. His attempt to make the 1800-mile trip non-stop was cut short 300 miles from Oshkosh when he made a precautionary stop due to rising oil temperature. He made the 1500-mile leg in eight hours, 50 minutes for an average ground speed of 170 mph. Engine oil problems aborted a Saturday attempt to set a distance record, and the engine was changed over night. On the last day, August 4, of the EAA convention at Oshkosh, Dick set a new World's record for closed-course distance. He flew a total of 13 hours, 8 minutes; covered an official distance of 1638 miles - actual distance was about 1660 miles. Average power setting for the flight was approximately 40 to 50% power. The 1700-cc VW engine used 38.4 gallons of fuel. Dick had an uneventful flight back to his home in Tucson, Arizona the day after the record flight: he averaged about 155 mph on his trip home at approximately 60% power, and obtained approximately 53 mpg at 10,000-ft altitude. I understand that a detailed story of the VariEze's activity at Oshkosh will appear in the October issue of "Sport Aviation." So enough said - read your magazine. Carolyn and I gave the VariViggen SP wings a real

shakedown by taking the Denver - Las Vegas route home, instead of the Albuquerque course normally selected in the summer due to the high altitude. The VariViggen performed well at the required density altitude of 16,000 ft crossing the Continental Divide. True air speeds as high as 159 mph were obtained at a cruising altitude of 7500 feet. After returning from Oshkosh the VariViggen and VariEze logbooks showed 550 and 130 hours, respectively. The VariViggen did not fly as much at Oshkosh this year as it has in the past due to our time constraints with the VariEze record attempts. However, rides were given to Jack Cox of "Sport Aviation" and Don Dwiggins of "Plane & Pilot" magazines.

We were extremely pleased to be presented the "Outstanding New Design" trophy for the VariEze. This is the same award garnered by the VariViggen in 1974. This year RAF had a booth to display plans and components for the VariViggen and to answer questions about our up-coming VariEze program.

George Mead has joined us this month. He is a capable engineer with extensive practical light-plane experience. He will be helping on both the VariViggen and VariEze programs. Many of you met Gary Morris at Oshkosh - he is as much an artist (he did the art work for the masthead) as a craftsman in fiberglass work. (Another big accomplishment was Gary having his hair cut!)

FLASH - It's now official; VariEze World's distance record has now been certified and registered in the list of official F.A.I. Records

CP06, Page 1

VARIEZE PROGRESS REPORT - The most important news is that we have definitely solved the deficient low-speed roll rate and have lowered the stall speed by eight knots. I really wasn't too confident that the new canard with its new airfoil and elevon would make enough difference in roll rate at low speed. Before the new canard was ready for flight tests, I had made a detailed design study of a control system which included conventional ailerons on the rear wing. Those drawings are now in the trash can: we are keeping the canard elevons, the clean wing, and the super simple control system. The aerodynamic improvement with the new low-Reynolds number airfoil and slotted elevon is the most dramatic change I have seen occur without a major planform revision. Not only did the maximum lift increase by over 50%, the slope of the lift curve was increased by 30% changing the once "nose heavy" feel and high stick forces to a too-sensitive condition. I subsequently reduced the new canard's area and revised its elevon balance point to obtain what I now feel are near optimum. The new canard does not have the external trim tabs on the elevons.

With the old canard the aircraft would exhibit a nose-down stall break at 58 to 60 knots. With the new canard the aircraft can be flown at full aft stick at 52 knots and at a much greater angle of attack. Also with the old canard, roll-rate capability degraded below 80 knots and rudder control was needed for adequate roll below 70 knots. The new canard elevons result in roll performance very similar or better than the average light plane. A 60-degree bank change can be accomplished in less than three seconds even below 60 knots and roll control is adequate even at 52 knots. I have landed the airplane several times in

the relaxed cruise position, with my feet in front of the rudder pedals. The overall maneuverability has been greatly enhanced.

I don't yet know if the VariEze will have the same low susceptibility to stall/spin as the VariViggen. It is possible but I won't know until all tests are completed. I do not plan spin tests on the prototype, N7EZ. The homebuilt prototype will be equipped with the appropriate instrumentation and recovery devise and a complete spin-test program will be flown before the construction plans are released.

The initial printing of the VariEze information kit stated that the aircraft was capable of 70 mpg at the economy cruise speed. This was based on flight test data at 10,000-feet altitude in which we obtained 61 mpg without a mixture control. Using standard corrections it was calculated that the carburetor was full rich and that 70.5 mpg would be obtained once a mixture control was installed and leaned to best mixture at 10,000 feet. It was later found that the carburetor was already jetted too lean and thus, only about 62 mpg can be obtained. The following table now appears in the information kit and shows the current estimates for a homebuilt VariEze.

VARIEZE PERFORMANCE TABLES OMITTED

VARIEZE HOMEBUILT PROTOTYPE

Many people have asked why we are building a second airplane; why not just sell plans for N7EZ? First of all, N7EZ was built without any tooling. Tooling will be required to build the following parts for the homebuilt kits: wing quick disconnects, cowling, main and nose landing gear, and canopy. We are building an airplane from the first parts to come from the tools; thus it will be assured that the parts will fit properly. Secondly, N7EZ was designed around the lightest (140-1) version of the VW engine, to maximize the amount of fuel which could be carried for distance records. It has become obvious to me that many people will insist on heavy accessories and will want to adapt the Continental series aircraft engines which can weigh as much as 197 pounds even without starter and with a a light alternator. This heavy an installation would not be practical for N7EZ.

When comparing engine price based on 1200 flight hours, the price of the aircraft engine becomes quite competitive with the lower cost, less durable VW conversions. My own experience, though quite limited (N7EZ now has 160 flight hours since first flight last May), points to the advisability of paying the higher initial costs for a definitely reliable powerplant. This is not to conclude that the VW cannot be converted and operated reliably by an experienced individual using aircraft-quality components and proper installation practice. There are available, however, conversion components and built-up engines which are not thoroughly proven and are not up to accepted aircraft reliability standards. For this reason I am making relatively major design changes which will allow installation of engines weighing as much as 198 pounds, and thus, make it possible to adapt Continental aircraft engines.

The homebuilt prototype will have a Continental 0-200B engine (100 hp) which I estimate will climb nearly 2500 fpm and cruise 210 mph at 75% power. The C-90, C-85, C-75, and C-65 Continental engines will also be ideal. The empty weight of the 0-200-powered aircraft will be about 480 lb, gross, about 980. A 1700 cc to 2100 cc VW conversion can also be adapted. Empty weight of the VW-powered aircraft will be about 430 lb, gross, about 880 lb. The additional wing area and stronger landing gear needed to provide for the heavier engine will compromise the cruise speed of a VW-powered aircraft, but by only four to seven knots. Do not write us at this time for advise on the VW engine. We will not be in a position to make any recommendations until the plans are available. I plan to keep flying N7EZ as much as possible to gain more experience with the VW installation. After some modifications we will make an assault on the straight-line distance record with a San Francisco to Miami flight (2600+ miles, including extensive night flying), possibly this fall/winter.

Additional changes being incorporated in the homebuilt prototype include

1. shallower fuselage and taller canopy to improve downward visibility over the side

2. roll-over structure

3. longer nose and locations of instrument panel further forward to allow knees to be placed forward after sitting down

4. more room in the back seat and more baggage room

5. instrument panel which can house NAV COM, transponder, eight 3-inch instruments plus all engine instruments. This allows IFR equipment without need for the expensive miniature primary instruments.

6. revised side-stick control configuration which greatly improves human factors and further simplifies control system (don't call - we cannot release details yet).

7. fuel capacity increased to 20+ gallons

8. increased aspect ratio on canard

9. improved nosegear retraction mechanism (N7EZ's nose gear retracted during landing rollout at Oshkosh probably due to inadequate down-lock indication - damage was minor.)

10. larger maingear tires and improved brakes (N7EZ had difficulty taxiing through the larger ruts off the runway at Oshkosh).

11. elimination of plywood formers - these are being replaced with glassed high-density PVC foam, thus saving 4-lb weight and eliminating any possibility of deterioration

12. further simplification of the fuel system

13. use of special resins in landing gear to eliminate slight tendency to creep

14. further simplification of the structure and about a 5% reduction in the number of parts. We are confident that the airplane can be constructed in 400 to 700 man-hours from to-be-available components and materials.

The wing-disconnect system will not be as shown in the VariEze information kit. We found that production of the three-piece glass spars would be too expensive. In the interest of keeping kit price as low as possible we are using a machined assembly at each wing attach point. Half of the assembly is installed on the wing during wing construction. The other half is installed on the center spar during its layup. Removal of each wing for trailering will involve removal of two bolts, each holding two large taper pins. Removal of the canard is by two shear bolts reached through the cockpit rather than by the two external tension bolts previously used on N7EZ.

While the larger main tires will improve rough field operation, it is not yet known whether routine operation from other than smooth surfaces will be advised. I will have an answer on this by the time the plans are available. I do not plan, though to compromise the efficient high-speed cruise to provide rough/soft field capability.

VARIEZE TO BE OFFERED AS COMPLETE KIT

The VariEze info kit explains that RAF will make available the machined parts and several components such as landing gear, canopy, cowling, and wing fittings. We are, however, now working with several companies to supply portions of all the materials required. The selection of these companies is being based primarily on their delivery history - for example the company which will be authorized by us and supported by us from an engineering standpoint to supply the foam kit, will be the one which we think will be most likely to provide prompt, quality delivery of the foam. We must work directly with them, since it is essential that the proper type and amount be used and that they respond immediately to any engineering changes.

It would be unwise for RAF, itself, to expand to produce the entire kit, since it would take years to attain the efficiency of established companies in a variety of parts and materials. The fiberglass cloth, previously available only from Europe will be woven in the U.S.A. and distributed by a company equipped to deliver. When the customer receives VariEze plans, he will be referred to specific U.S. companies, authorized by us and who have our engineering support, to purchase the following kits or individual items: 1. machined parts, 2. foam kit which consists of three types in five different densities, 3. glass, epoxy, flox, and microballoons, 4. hardware, 5. landing gear, 6. canopy, 7. cowling, 8. finishing materials. It may seem awkward to deal with three or four companies to obtain a complete VariEze kit, but this is not the case, since each is selected for its record of capable and prompt delivery service. Each company selected will not only receive our continuous engineering support but must live up to our contractual delivery schedules.

Only two of the eight kit areas have been specifically selected at this time. If you are a good, established company, currently handling any of these type items, and would like to supply kits, please contact us.

BUYER BEWARE - Buying the wrong fiberglass, epoxy, etc., can be the same as using conduit to build a steel-tube airplane instead of 4130. Remember, the years of testing and flight experience of glass aircraft points to a very important fact: You must use the correct materials. True, it is possible that another product could do the job, but to verify this would mean starting from zero with tests for strength, workability, weight, compatibility, exposure to environment, etc. Since we do not want to take years more to develop the structure, we must insist that the builder use the products we will specify in the plans. Do not buy any product now. We have already had companies indicating that their products can be used on VariEze construction without having even a grasp of the structural requirements!

QUESTIONS/ANSWERS ABOUT THE VARIEZE
The following are some answers to questions asked about the VariEze. If you have further questions, write them down and send them in and we will answer them in the next newsletter. Do not visit RAF expecting to see N7EZ or anything related to the VariEze. We have been working at low efficiency recently because of the flood of visitors. N7EZ is shown only when it is out of the hangar, flying - otherwise we have to keep it locked up so we can work. We cannot answer questions individually which aren't answered here or in the VariEze information kit. This policy will change as soon as we have the plans on the market - after that time, you will be welcomed to come up for a flight demo/ride, structural demo, construction methods demo, etc. We just can't afford to demonstrate something we aren't currently selling.

1. Isn't the small cockpit cramped? No, in fact the seat has been very carefully engineered for long term comfort. Dick found more discomfort with four hours in a Cherokee than 13 1/2 hours in the VariEze. I've spent as much as seven hours per day in it without even wanting to get out to stretch after landing. The comfort is obtained by a combination of the high thigh support, lumbar support, and correct height of arm rests, which relieves the back. The variety of foot/leg positions and ability to trim hands-off for long time periods, also adds to comfort.

2. Is cockpit heat required? No, due to the excellent insulation provided by the composite structure, the canopy will even keep the feet warm. Cold night flying is generally rare enough to not justify a heat system.

3. What is the glide ratio? At idle power (close to zero thrust) and 72-knots airspeed, glide ratio is 18.8.

4. Are dual controls planned? No. Again, I do not plan to compromise the design simplicity to do a mission other than that of efficient cruise. Learn to fly in an airplane which was designed as a trainer. Dual controls would triple the number of parts in the control system and eliminate one suit case. Also, controls could be jammed when flying solo with baggage in the back seat. Currently there is nothing in the back seat which moves (except Carolyn). Four pilots

have been successfully checked out in N7EZ - none of them had side-stick experience.)

5. Is the VariEze an aerobatic airplane? No, providing for that capability would mean compromising the design goal of best efficiency at high-speed cruise. However, it does appear that the basic aerobatic maneuvers will be satisfactory. By the time the plans are available, I will list any allowed maneuvers and limitations.

VARIVIGGEN WEIGHT AND BALANCE METHOD

Since several VariViggen builder's are getting close to first-flight time and will be needing to do an accurate weight and balance, the following is provided to add some details not shown in the plans:

Materials Required - Three scales, two must be capable of weighing up to 500 lb, the other can be a bathroom scale - although I've seen someone do a reasonable job with five bathroom scales, placing a board (weight of board subtracted later) between pairs of two for each main wheel. (Borrow the scales!) Assure that the scales are accurate - test each with a known weight in the expected range. Caution on low cost bathroom scales - you may have to make a board to distribute the load to prevent warping the table, which will give an inaccurate weighing. You will also need a level, plumb bob, 12-ft tape measure, and chalk line. The average VariViggen will need nose ballast to sit comfortably on its three gear in a level attitude. Place a known weight at a known fuselage station - 50 lb in the front seat at F.S.60, for example.

Level the aircraft, using a carpenter's level on the flat bottom of the wing. Adjust it down by bleeding the air from the nosegear strut or up by placing a block under the nose tire. Now take the plumb bob and mark a point on the floor corresponding to each maingear axle centerline and both sides of the nosegear axle centerline. Use the plumb bob to mark a line on the floor corresponding to a known fuselage station - the most convenient is F.S.19.75, holding the plumb in line with the joint of the nose cone and the forward edge of F20. Now move the aircraft and make chalk lines on the floor as shown between the mainwheel reaction points, the nosegear points, and the two F.S. 19.75 points. Measure the distance between F.S.19.75 and the nosegear and maingear action points, for example 8.05 in and 110.15 in making the nose gear at F.S.27.8 and the main gear at F.S.129.9. **SKETCH OMITTED**

Now, get the help of a couple of friends to lift the wing tip while you slip the scale under each main wheel, one at a time, and a scale under the nose wheel. Recheck level attitude and read the scales - tap them to be sure friction is not effecting the readings. Remove the aircraft and record tare weight - chocks, boards, etc. Now setup the following table - be sure to state status of equipment. Note that ballast weight and moment are subtracted.

LOCATION	GROSS	TARE	NET	ARM	MOMENT
RT MAIN	481	+2	479	129.9	62,222
LT MAIN	497	+3	494	129.9	64,170

NOSE	12	+1	11	27.8	306
SUBTRACT BALLAST			-50	60	-3,000
TOTAL EMPTY WT			934		123,698
EMPTY CG =			123,698/934	=	132.44

You now know the empty weight and empty cg and are ready to calculate your weight and cg for your first flight. Assume you weigh 175 lb, your parachute weighs 18 lb, and you will carry 25 gallons (150 lb at F.S.137) fuel. Make up the following table:

DATE 25 SEP 73
VARIVIGGEN N15VV
S/N 394
FUEL DRAINED TO UNUSABLE
OIL 6 QT
NARCO XYZ RADIO
BASIC INSTRUMENTS

	WEIGHT	ARM	MOMENT
EMPTY AIRCRAFT	934	132.44	123,698
PILOT	175	62	10,850
CHUTE	18	64	1,152
FUEL	150	137	20,550
TOTAL	1277		156,250

cg= 156250/1277 = 122.36

Now, checking on page 3 of the plans, a cg of 122.36 is within the envelope suggested - so follow the maiden flight procedure in newsletter #2 and happy flying.

CP06, Page 5

VARIVIGGEN SPECIAL PERFORMANCE WING

The new composite outer wing panel for the VariViggen has been flown about 80 hours now. The performance figures stated in newsletter #5 are accurate and the structural durability is excellent.

We are now working with various suppliers for foam, epoxy, and glass, so there should be no problem obtaining any of the materials. The SP wing plans will be available the first week of November, but we won't know the price of the plans until October 22. Those who need the plans before the January newsletter can contact us after the above date to receive further information. Complete details will be in newsletter #7 for those who won't need them before January. The special unidirectional fiberglass which is being woven for us, will be available by mid December. Those who will need it before then can contact us and we can supply a substitute from our stock. Please don't unless you absolutely need it right away, since we're not presently equipped for a large volume. The price will be much lower after the manufacturer weaves the large order.

Should your VariViggen have the SP wing? The decision is yours. Personally, I like the extra climb, cruise performance, and lower rate of sink, but the roll rate is lower and the stall margin is less. Tuft tests have shown some stalling of a small amount of the SP wing near the tip at less than 47 knots - this is very close to the minimum

attainable speed. This tip airfoil separation results in a slight buffet and "wander" in pitch and roll when near and at full aft stick. Full aft stick can be maintained with power for level flight (or greater) without any stall break or roll-off, and roll control at full aft stick is good. However, the aircraft doesn't have as solid a 'feel' as the standard wing below 50 knots. Accelerated stalls (in a turn) are smooth and solid with power settings of 2100 rpm or more. Accelerated stalls with less power do result in some bucking and slight wing rock.

In one instance, George Mead experienced a 1/2 snap roll as he was pulling up from a dive and rolling. This occurred during simulated air combat with the VariEze. I haven't done a complete spin program with the SP wing, so I don't know if it could be spun. This brings up another point: Someone mentioned to me at Oshkosh that he was flying his radio-controlled model VariViggen (I assume with the standard wing), and he experienced a spin which was entered when the engine quit in a turn and was not recovered. This is baffling to me, since my spin test model would not spin, regardless of the control or throttle inputs. At least 75 spin attempts were made. Also the full-size aircraft can maintain full spin controls indefinitely without spin entry. In fact, for airshows I have done a pass by the crowd many times with full rudder and full aft stick at low altitude. I asked the gentleman, who's name I don't have, to send me a complete report of the models configuration, incidences, cg, and control deflections, but I haven't heard from him yet.

Now back to your decision. While the SP stall margin is less, the airplane is still quite resistant to stall during normal flight maneuvers, is very maneuverable at low speed, and quite safe. I strongly recommend the SP wing for those installing 125-hp engines or those with 150-hp engines who plan to routinely operate near gross weight, from short fields, or at high density altitudes. The additional stability provided by the winglets also improves high-speed flying qualities. If you don't plan to operate heavily loaded and like the fighter-like roll rate and extra stall margin, then select the standard wing.

In newsletter #5, I passed on to you some preliminary thoughts regarding reflex and nosegear length with the SP wing. First, concerning the nosegear length, I do not recommend lengthening the gear to obtain lower rotation speed. The maingear position (F.S.129.8) is already moved approximately 1 1/2" forward of that on N27VV to lower the rotation speed and lessen the load on the nose gear on rough fields. I think that lengthening the nose gear would make the airplane too difficult to handle when sitting on the ground without someone seated in the cockpit. It would take more load to hold the nose down before getting in and would make that first step too high.

I do recommend that you retain the variable reflex with the SP wing. You will find the up-reflex helpful to obtain minimum ground run for short fields and having the reflex down or neutral adds more stall margin for the aft wing. If you are a nut for simplicity and aren't planning short field operations, you can disregard the reflex. Merely rig the neutral-aileron position of the AB8 belcrank to the zero reflex position shown on page 40 of the plans. The SP wing plans will show you the correct reflex of the aileron.

VOR ANTENNAE LENGTH
Someone told me that the 14-inch length VOR antennae should be 16.6"; another said 26" but it depends on the balun, or coax loop. I have the system shown on the plans on N27VV and I get excellent accuracy and about 80-mile range. Is there an antennae expert out there who would like to write a blurb on homebuilt VOR antennaes for a future newsletter??

VARIVIGGEN BUILDING TIPS
Fit of F41 Bulkhead to F27 Visor - A previous newsletter suggested that you leave excess plywood on the top of F41 to fit it to the RAF-supplied F27 fiberglass visor. The following drawing shows the F41 contour required to fit F27: **SKETCH OMITTED**

Wayne Koch reports that the gear on the Ford window-motor assembly is a 9-tooth, 12-pitch 14 1/2-degree gear, and that the extra gear shown in newsletter #4 can be eliminated. This is true only of the Ford, not the Dodge motor. A Boston #ND30 will mesh directly with the Ford motor and provide the correct ratio for the nose gear. For the main gear use a Boston # ND64. Unfortunately the 12-pitch gears aren't available in a light narrow flange variety, however, the 3/4-inch flange can be turned down to save room and weight. The following drawing shows how the 5.5" dia. main gear can be mounted to clear the aileron cable. Photos will be available with the 2nd part of the construction manual. **SKETCH OMITTED**

Be sure to follow the order shown on the plans when rigging the main gear. First, adjust pushrod MG6 to obtain correct down lock action. Then retract gear and position the correct over center position of MG5, adjusting the uplock action with the uplock turnbuckle. Then drill MG14 into MG12 and install bolts through MG14. Extend gear and accept the extended position.

The following are tips sent in by Jim Cavis concerning the main gear. "When welding pivot on MG16, put a bolt through it so it will keep its shape. After making and drilling MG16, use it as a guide to drill through spars. Cable can slip on MG42 unless it is passed through spool like on nose gear. Once this is done, you can't get the cable and MG42 through the holes in the ribs. I made my cables up in three sections, so motor and MG42 can be removed without removing MG9 pulleys." **SKETCHES OMITTED**

"I used a 5/8"x.125 steel tube for MG36. I tapped the end and used a fabroid 77330 rod end threaded into the end in place of the Heim HF-5C (plans page 47)." Jim also made an acceptable substitution to the MG20 bracket. Instead of bolting to WR46 rib and the spar, he just bent up two aluminum angles (top and bottom of pulley) and bolted them to the spar. **SKETCHES OMITTED**

Bulkhead Assembly - Remember, if you are assembling the bulkheads from several parts rather than cutting them out in one piece (to save plywood) you don't have to make scarf joints - just overlap the pieces, giving at least 3 square inches of overlap at each joint. This applies

to the bulkheads sold by RAF. The bulkheads are sized to provide sufficient glueing area to the skin and are much stronger than they need to be for all other loads.

Inclined Bulkheads - Use a plumb bob from the bulkhead tops to the jig to check incline. This assures an accurate slant. If the F121 bulkhead is not slanted enough, the F28 tank cover may not fit. If this is the case, you can knock the bulkhead loose from the stringers and move it back, provided you haven't already skinned the fuselage sides.

Maingear Rigging - If you move the pivot for MG5 and MG9 pulley to B.L.34.15 as suggested in newsletter #4 (when using RAF-supplied MG4) you may have to bend the uplock belcrank (MG29) outboard more and cut away a portion of rib 36.5A for clearance.

VARIVIGGEN GEAR-UP LANDING SAGA #2 & #3

On our way to Oshkosh this year, Carolyn and I again were faced with having to land N27VV with the main gear retracted. We landed on a hard surface runway with the nose gear extended. We got the prop stopped before touchdown and slid out on the rear skids and nose gear. Again, the nose gear took the load with no damage; all damage was limited to the two aft skids and a non-critical scrape on the aileron control arms. Inspection revealed the problem to be the same uplock spring which caused the gear to remain locked up three months earlier at the Corona flyin (see newsletter #4). We were on our way that afternoon again, after pinning the main gear down, and flew the remainder of the trip to Oshkosh with the main gear down. The next day at Oshkosh we repaired the skids and rerigged the main gear to put it back in operation.

This time the uplock springs loop had somehow slipped out of the bracket rather than failing like it had at Corona. The spring loop was returned to the bracket, this time twisting it backwards so its own torsion wouldn't tend to remove it.

I feel quite embarrassed by having this spring fail - twice! After all, a spring is something to trust, like gravity. I am recommending that you install a simple addition which consists of adding a branch to the existing emergency extension cable. The present emergency extension cable removes the electric motor from the system, allowing the uplock return springs to push the gear overcenter so it can freefall down; this only backs up a failure of the electrical motor, and cannot extend the gear if the uplock springs fail or if the uplock would jam. By simply adding cables to the existing emergency cable and routing them to the top of the uplock belcranks, the emergency handle would not only remove the motor, but would pull the uplocks out and force the gear overcenter and on its way down. Thus, the emergency handle overrides a spring failure and any jam of the gear. The following drawings show how this is done:

Rig the cables so the motor is removed first, then a further pull of the handle forces the uplocks out and the gear down. **SKETCH OMITTED**

Gearup landing #3 - This one is of no real concern to builders, since it does not involve a problem which can occur with your aircraft, since an obvious design improvement was incorporated into the plans before they were first released. The failure allowed the MG5 bolt to slip past the MG29 bolt during gear retraction. As such, the microswitch on MG29 was not activated and the gear motor continued to run, jamming the gear way over center and failing the cable. This failure occurred on the third flight of the day at the EAA Western flyin at Tulare, California; with Bob Eldridge in the back seat, I had taken off to compete in the spot landing contest. Since there was a lot of activity on the runway at Tulare, we decided to fly to another airport about 20 miles away to do our gear-up landing there. The landing on the nose gear and aft skids was uneventful (routine?), the gear was fixed and we flew back to Tulare to compete in the spot landing contest.

NOW - I don't expect to hear from any more of the VariEze fans about wanting to retract the main gear!

Surface Finish - There are many acceptable ways to apply finish over the external wood skin. The following is the procedure used on N27VV: The wood is sanded with 80 or 100-grit sandpaper on a hard block, taking care to level areas around skin splices. Mix up a mixture of epoxy and microballoons (available from Gougeon Brother) and trowel into low places, fill gaps around joints, and form a 1/2" radius at the wing-fuselage and wing-vertical stab junctions. When dry, sand again. Apply the lightest available ceconite (available from Stitts); I think its 1.7-oz weight. Shrink down smooth and apply two or three coats of dope to fill the weave. Be sure to run the ceconite around easily-damaged areas like trailing edges. Sand when dry with 220 grit. Apply two coats of lacquer primer/surfacer (Dupont or eq), wet sanding after each coat with 320 grit. Finish by spraying on your favorite color Dupont Dulux enamel. Finish internal wood surfaces with epoxy as shown in the plans.

The glass SP wings are finished differently. Finishing details will be supplied with the plans. Remember if you use the glass SP wings, they (like all glass sailplanes) must be painted white. This keeps the glass resin below 120 degrees even in the hot sun and prevents it from losing its stiffness. An alternative is to use a high temperature phenolic resin in constructing the wings, but that can triple the resin cost. (For the same reason all VariEze aircraft will be all white, with a limited amount of trim color.) We are testing a polyester white finish which can be sanded and buffed the next day after spraying. More details on this later.

If anyone has wood aircraft finishing suggestions, send them in for future newsletters.

VARIVIGGEN PLANS CHANGES
Be sure to incorporate these revisions into your plans now.

Location PL - Plans
TR - Tech Report
NL - Previous Newsletters

CAT - Catalog
Category of Change
MEO - Minor error or omission
OPT - Optional improvement
DES - Desirous change - does not effect flight safety but should be incorporated to improve aircraft or correct a fault
MAN - Mandatory change - must be incorporated as safety of flight is affected

Category	Location	Change
MEO	PL pg 52	Nosegear door attaches to F32, not F20.
MEO	PL pg 14	View BB (from page 13) should not show C6 on the aft side of the forward spar. C6 is not required on the aft side outboard of B.L.24. See top view.
MEO	PL pg 13	The four bolts which attach canard spars to bulkheads are at W.L.22.85, not W.L..85. Be sure to epoxy, as well as bolt the canard to the bulkheads.
MEO	PL pg 25	SPAR D - The solid line drawn between the W1 gussets on the left should be erased - its presence indicates a spar web which isn't there.
MEO	PL pg 37	F.S. of trim pivot is 35.6, not 135.6.
MEO	PL pg 4	Aluminum tube - RM1 is fabricated from an aluminum bar, not from standard tube stock. Erase it from the tube bill of materials.
MEO	PL pg 25	Spar F butts to WS28, not to WS29.
MEO	PL pg 38	SA1 square tube forward end is at F.S.54.2, not F.S.154.2
MEO	PL pg 51	Upper left of page, MG20 center of pulley is at W.L.5.0.
MEO	PL pg 41	Faded words to left of brake master cylinder read "1/4" bulkhead fitting through F31-AN833-4D".
MAN	PL Chapter 19	Add the modification shown in this newsletter to expand the capabilities of the emergency maingear emergency extension system.

SHOPPING
If you are having trouble finding the DOAN#31-2014 rubber shocks, it may help to know that they are also listed as American Parts #2-2014 or Borg Warner #31-2014 or Anchor #31-2014.

I understand that a substitute for the Stanley 61-112 is a Lufkin # C9212-X. This is available at most surveying supply houses or through Robert Lamishaw - Lamco Enterprises, 3660 Wilshire, L.A., Ca. 90010. Also Francis Falejczyk, 7881 Seneca St., East Aurora, N.Y. 14052 says he has decimal 12-foot chrome cload tapes for $5 - postage included. Be sure you get one graduated in inches and decimals (10th & 100ths) of an inch. I've seen some rules graduated in decimals of feet - these are worthless to you.

We're still recommending Gougeon's west system epoxy as one of the most economical and convenient adhesives. The tests I am running with this

epoxy are most encouraging. An added advantage is its low toxicity - it doesn't effect the skin as much as most others. Be sure to add the 401 short fibers to increase viscosity to fill gaps greater than 1/32". The following order will go a long way and the mixer pumps save a lot of time weighing out each batch:

105 Resin	1 gal	$19.35
206 Hardener	1 qt	5.00
401 Shortfibers	1 lb	1.90
Mini pumps	1 set	2.75
Applicators	3 doz	3.00

Order from Gougeon Brothers, 706 Martin St., Bay City, Mi. 48706.

Jesse Wright S/N 91, is now manufacturing a kit of parts for the canard and elevators. The kit includes the following parts - routed to final shape and tapered where required: C-6, ER, ER1, E4, E6, C11, E5, CR1, CR and CRT1 - a total of 75 parts in all. I have inspected the kit and found it to be of excellent quality, using birch plywood. The kit does not include the spruce spars - those are in the spruce kit already available from Aircraft Spruce & Specialties, Fullerton, Ca. 92632. With these kits available, the homebuilder has only to assemble completed pieces, with little fitting or shaping required.

Do not order the canard kit from RAF. Contact Jesse Wright directly at 7221 S. Colorado Ct., Littleton, Co. 80122 (303) 711-5140. His price is $116.00, which includes all packaging and shipping, anywhere within U.S.A. or Canada.

Jesse will also have a complete kit of manufactured (routed parts to final shape) bulkheads available by November 15th. Contact him after that date for price and availability. We have not been satisfied with the service provided by the vendor of the drawn bulkhead kit now shown in the RAF catalog. Once the routed parts are available from Mr. Wright and have been approved by us, we will discontinue the drawn bulkhead kit. The routed bulkheads will save the homebuilder a considerable amount of work and guarantee him accurate, splinter-free edges. Mr. Wright plans to offer routed inboard wing ribs by mid December.

Good news for those who have asked us to make MG14 maingear legs available, George Evans, 4102 Twining, Riverside, Ca. 92509 has already made three shipsets for local VariViggen builders. They are of first-rate quality, welded of 4130 steel, heat treated, cadmium plated, and baked. The lower tube is honed for a perfect fit on the MG30 trunions. All tabs are welded in place and the uplock bolt hole is drilled/ tapped (see plans page 48). We are working with Mr. Evans on this item, but will not handle this in the RAF catalog; call (714-683-3963) or write Mr. Evans directly to order. He will also make available the MG32 trailing arm aluminum bars and the welded steel NG25/NG26/NG24/NG23/NG27 assembly.

VariViggen angle-of-attack system, fully assembled with or without meter, all components assembled to back of meter on printed circuit board - write Allen Vaughn (S/N 348), 1915 Florida St., Huntington Beach, Ca. 92648, or call (714)-536-8122, for price and availability.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Carrol Holzworth's (SN2) VariViggen with vertical fins in place & RAF fiberglass parts.

VariViggen exhaust system in jig ready for welding.

Beginning the takeoff roll for the World's record flight.

Carolyn, Dick, Burt, & Prof. Ed Lesher getting N7EZ ready for the record attempt (note fuel tank in back seat).

N7EZ arrives at Oshkosh.

N7EZ & Ed Lesher's Teal - the Teal was the previous distance-record holder.

Dick climbing out after 14 hours in the cockpit & Harold Best-Devereaux removing the barograph.

Dick on N27VV planning the "VariEze" trip home.

THE CANARD PUSHER No. 7 JAN 76

NEWS OF THE VARIVIGGEN AND VARIEZE PROGRAMS
(very vig-in) (very easy)

RUTAN AIRCRAFT FACTORY
PUBLISHED QUARTERLY BY Burt & Carolyn Rutan
JAN, APL, JLY, OCT Bldg. 13, Mojave Airport
P. O. Box 656, Mojave, Ca. 93501

NEWSLETTER SUBSCRIPTION - $4.75/year
OVERSEAS SUBSCRIPTION - $6.25/year
BACK ISSUES - $1.00 each

RAF ACTIVITY since the October newsletter has been primarily the construction of the VariEze homebuilt prototype. This aircraft (N4EZ) is the Continental-powered aircraft that we are basing the plans on. See "Canard Pusher" number 6 for a complete description of the differences between the two prototypes. Construction of N4EZ was started on 15 October 1976. It is now (14 January 1976) being primered and finished. Yet to be completed are the cowling, instrument installation and hooking up the engine controls. It should be flying by the first week in February. Assuming that all flight tests go as expected, including spin tests and dive tests to 240 kt, and no large delays are encountered, we expect to have the plans and construction manuals on the market in April or May. Most likely, our April "Canard Pusher" will be the first announcement of plans availability.

VariEze static load tests conducted recently include the canard, winglet attach, elevon brackets, monocoque wing section, and several component tests. All results confirm the high safety factors previously claimed. We plan to static test an entire wing and attachment as soon as we can find something strong enough to mount it on!

Both the VariViggen and VariEze have been flying extensively over the last few months. N7EZ now has 220 hours; N27VV, about 570. Pilots checked out for solo in the VariEze include Peter Garrison, Tom Jewett, Peter Lert, George Mead, Jerry Slocum, Tom Poberezny, Dick and Burt Rutan. Approximately 75 people have been given backseat rides. Both the VariViggen and VariEze have been relatively maintenance-free over the last several months.

Since November, we have been giving weekly demos of our aircraft. Every Saturday from noon to 2 P.M. we roll the airplanes out of the hangar, discuss their features, give flight demos and rides in the VariViggen and VariEze. The demos start in our building - 100 yd southeast of the tower building on Mojave airport. We plan to continue giving these demos at least until the VariEze is on the market (April or May 1976). Until then, do not expect to see the VariEze at any other time of the week. Showing it on an individual basis has taken a large part of our time and has delayed the program. After it is on the market, come by at any time!

PHOTOGRAPHS OF VARIEZE, VARIVIGGEN AND VARIEZE CANARD OMITTED

We still have not seen any VariViggen projects appear in the "Sport Aviation" "What Our Members Are Building" page. Come on guys - send Jack Cox a photo and description of your project.

THE VARIVIGGEN OWNER'S MANUAL has been finished at last! It will be available for mailing in mid February. The owner's manual is a complete operational handbook for the plans built VariViggen including normal and emergency procedures, loading graphs, operations checklists, complete performance information for standard and SP wings, 150 and 180 hp. Also included are an expanded flight test section, maintenance checklists, record keeping section and much previously unpublished operational info. The manual is in a handy 5-in by 8-in size so that it will fit in the cockpit map pocket. The owner's manual will cost $6.00 including first class postage (within U.S.A.). This manual is a must for those close to first flight.

NEW VOR AND COM ANTENNAS AVAILABLE
We have been working with a group of electronic wizards on the development of a set of antennas for the VariEze and the results have been excellent. These units are 'zero drag,' immersed-type, antennas, specifically designed for composite or wooden aircraft. The performance of these units is equal to the very expensive broad band antennas. While designed primarily for the VariEze, these antennas are excellent for the Viggen as well.

We've received a number of comments on the VariViggen plans VOR antenna, most indicating that we don't show the 'optimum' antenna. This is true, but don't rip your canard apart if it's already installed. The plans antenna works well, but if you want the best possible antenna, there are other ways to go. Frank Stites of Stites Engineering Company, Wayland, Mass. has been kind enough to run a series of tests on antenna efficiency for us. He found that the antenna shown in the VariViggen plans received between 65 and 70 percent of the available signal. Extending the plans antenna arms by 2.45 inches (14.15 to 16.6) improves its reception to between 78 and 85 percent of the available signal. Our new antenna receives between 83 and 92 percent of the signal. There are antenna designs which will capture about 98% of the signal, but they don't fit into our aircraft very well. For those of you who are radio buffs, the VSWR ratios of these antennas are plans antenna (14.15 long) VSWR 3.2 to 4.2, plans antenna extended to 16.6-in length VSWR 2.2 to 2.8, H.C. 100 (new) VSWR 2.5 to 1.7.

The new antennas are available now directly from the manufacturer (not RAF). You canard pushers (RAF customers) will get a $10 price break on each of the NAV and COM antennas from normal retail prices. These antennas require no balun (it's internal). You guys who just can't wait to have a VariEze part in your garage, can get these antennas early and you Viggen builders will find them very good antennas (see installation sketch below). Order directly from H.C. Communications, P.O. Bx 2047, Canoga Park, Ca. 91306. The prices are HC100 (NAV) $28.50 (normally $38.50), HC200 (COM) $26.50 (normally $36.50). All that you need is a B.N.C. connector on the end of your antenna lead.

California residents don't forget to add 6% for tax. H.C. Communications promises delivery within 14 days of receipt of your order. **SKETCH OF HC COM ANTENNA INSTALLATION IN VARIVIGGEN OMITTED**

Should you have questions which you want answered directly, please send a self-addressed, stamped envelope for our reply.

VARIVIGGEN FIBERGLASS PARTS
RAF has been handling the cowling, tank cover, nose cone, plexiglass dome, and visor for a year now with excellent results. These parts have been manufactured by a firm next door here in Mojave, so delivery has been excellent. This firm has decided to discontinue manufacturing those parts for us, and we're changing to another very capable firm. Unfortunately, our new manufacturer isn't right next door and to avoid any delay in delivery, we will be sending you directly to them with parts orders. We feel that this arrangement will get parts to you the quickest and most economical way. We do have a few ship-sets left here at RAF for those of you on the west coast who want to stop by and pick them up. We aren't equipped to pack or mail these few remaining sets. Send your new orders to Monnett Experimental Aircraft, Inc., 410 Adams St., Elgin, Il. 60120. There may be initially a small delay until Monnett gets production going on our tooling, but this should only take several weeks. The parts involved are F23, F27, F25, F28 and V-COWL.

VARIEZE UPDATE
Each newsletter we try to answer the questions sent in the past three months which haven't been previously answered in newsletters or the information kit. If we miss your favorite this time, write and ask again.

Cost: We look at the airframe cost two ways, the cheapest and the easiest. The biggest single factor is the engine; you can scare up a zero-since-major A-65 Continental for $700 if you're a good scrounger ($1500 if you aren't) or spring for a new $4000 0-200 from Teledyne. If you buy only the raw materials, no machined parts, weld your own engine mount, etc., you can probably pump out an airframe with instruments for about $1300. On the other hand, if you buy all prefabricated parts that will be available, landing gear struts, machined nose gear parts, main gear axles, engine mount, stick assembly, wing attach fittings, fuel caps, nose gear retract motor, spinner, finished rudder pedals, canopy, cowling, etc., you can invest about $2400. There will be a lot of happy combinations in between these two extremes.

Engines: Don't buy one yet. We'll make our recommendations after we've flown N4EZ. We plan to solve all the installation problems with the small Continentals and then proceed to the VW installation. No, Fred, you can't use an 0-320 Lycoming in your Eze, not even an 0-235, because they're too heavy. The Eze is basically a 60 to 80-hp airplane; The 100-hp Continental 0-200 without starter and a light alternator is the maximum. We are using an 0-200 only so that we can qualify the heaviest and most powerful installation and insure its

safety. If the engine you're thinking of weighs more than 200 lb, forget it!

Heavy Pilots: 210 lb is considered top. You could fly with lead in the tail, but it's bad practice and severely compromises the design. The VariViggen is more tolerant of you heavies. You tall troops can relax, though; 6 ft, 4 in fits just fine. Anybody over 6 ft, 6 in will have to raise the canopy, which is a VariEze job if done during construction.

EAA: You guys who aren't members, should be. If you aren't a member yet, borrow your friend's January "Sport Aviation" and read the 10-page Eze article. It's a more comprehensive article than any of those previously published, particularly in regards to the structure.

Registration Numbers: The FAA assigns these, not RAF; contact your local GADO for the application procedure.

Record Flights: These take time and gobble money. We have delayed the coast-to-coast attempt until after plans are out.

Wives: Due to your dress making skills, your participation in VariEze construction can be much more than in conventional construction. In fact, you will probably be responsible for about 20% of the effort, cutting the glass cloth. Cloth cutting needs to be done on a clean table with a good pair of scissors. Your skill in this area is probably better than hubby's and we're sure he will appreciate the help.

Mods and Goodies: Don't ask about dual controls, inertial navigation systems, lighting, heaters, starters, inverted fuel systems, ad infinitum, until the basic airplane is finished, thoroughly tested, and you have plans and parts in your hot little hands. We will develop many of these, but only after the basic configuration is completed.

Foam: All foams (kit includes three types, five different densities) will be available in the correct odd ball type and sizes from our distributors, as soon as the plans are out.

Epoxy: Our education is improving all the time. The Shell epon epoxy that we had been using is late 1950's technology. We are working with some more modern materials that have better peel strength and will tolerate higher heat without softening. These advances make for a stronger airplane and allow a choice of colors where the older resins commanded a basically white airplane. We have a bunch of testing to do on this resin yet, before we release details, but if all goes well, you can have that chartreuse airplane after all.

In recent weeks, we've had the opportunity to discuss at length our structure with the advanced composite materials department of a major aerospace firm. These guys spend about three to four million dollars a year on composite research. We were very much pleased to find that these true experts in composite structures had only complementary comments for our approach. This group has also been very helpful in recommending primers for complete protection of the foam and resin from ultra violet radiation.

Misc. Performance: No, you can't hit the prop when you flare to land or rotate to take off.

Altitude performance is excellent; even a normally aspirated engine will take the airplane higher than the pilot's lungs can go without oxygen.

No, there isn't any pitch trim change with throttle. If you cycle the throttle from idle to full suddenly, all you get is acceleration with zero pitch or yaw.

Specifications		Continental 0-200	Continental A-65	1800cc Volks.
Span-Ft. -	Wing/Canard	22.3/13.2	22.3/13.2	22.3/13.2
Area-square feet	Wing	53.6	53.6	53.6
	Canard	13.7	13.7	13.7
	Total Area	67.3	67.3	67.3
Road Towing Width - Ft.		5.7	5.7	5.7
Empty Weight - Lbs.		490	458	440
Useful Load - Lbs.		490	417	410
Gross Weight - Lbs.		980	875	850
Wing Loading - Lb./Square Ft		14.6	13.0	12.6
Power Loading - Lb./HP		9.8	13.5	13.7
Design "g"		+-6	+-6	+-6
Fuel - Gal.		20	20*	20*
Performance at Gross Weight				
Take Off Distance - Ft.		750	980	1050
Rate of Climb S/L - FPM		1800	900	900
Max. Cruise Speed (75%) - KT/MPH		181/208	156/179	152/175
Range at 75% Power - Miles		700	850*	870*
Economy Cruise Speed - KT/MPH		126/145	109/125	109/125
Range at Economy Cruise - Miles		1100	1200*	1200*
Stall Speed - KT/MPH		52/60	49/56	48/55
Landing Distance - Ft.		800	700	650
Performance Single Place, 2 Hr. Fuel				
Take Off Distance - Ft.		550	780	800
Rate of Climb S/L - FPM		2600	1600	1500
Stall Speed - KT/MPH		44/50	42/48	42/48

* For a crew weight of 300 lbs. total. Fuel and range is reduced for heavier people

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Cabin Noise: The cabin noise level in 7EZ is lower than most light airplanes; however we plan to improve this even more on 4EZ with the addition of a muffler.

Pusher Engines: As you engine experts know, the Continental 0-200 (100 hp), C85 and C90 engines have a special crankshaft for an FAA-approved pusher installation. These special cranks are rare and expensive. We don't believe that these special parts are necessary for the VariEze. The difference between the "pusher" 0-200 B and the tractor 0-200 A is a reinforced flange to take the high static thrust loads that you find in amphibian type or other slow aircraft. The 0-200, C85, C90, C75, A80, A75 and A65 crankshafts are almost identical (not interchangeable) and the A65 engine is approved as a pusher without modification. Because of the fixed-pitch prop, designed for 200-mph cruise, the

thrust loads on the 100-hp 0-200 A are lower than they are on the 65-hp A65 in a "normal" installation. It is possible that you might have to plug an oil passage in your crank case for improved lubrication. We are testing this on 4EZ and will include our findings and recommendations in the plans and later newsletters. **GRAPHS OMITTED**

Dealers: We've had a number of inquiries from individuals wanting to be "dealers" or "retailers" of plans, parts, etc. Our current situation is that we are under contract with several very reputable firms for the exclusive manufacturing and retailing of Eze materials and components. These contracts are in effect for two years as exclusive agreements. After this initial period, we will address expansion to a larger dealer network. In the meanwhile, we suggest that overseas customers wishing to save on import costs, make volume orders.

Building Skill: Many of you have expressed concern about the skill required to build the VariEze. If you can chew gum and walk a straight line simultaneously, you won't have any trouble at all. For those who have trouble with this, we will be holding seminars and demonstrations around the U.S. after the plans are out. Seriously, the skill required to make a good, safe structure is less than that required for sheet metal, wood, or welding.

Forget any experience you may have had with fiberglass using standard industrial weaves or boat cloth. The special weave cloth used on the VariEze requires only about one-half the time to lay up as you may be used to, and the low resin amount required to wet out the cloth results in a significant weight savings. The VariEze plans are much more than just drawings: they are a very detailed "education" and step-by-step construction procedure description. We even plan to tell you how many man-hours you should spend in each step. This allows the builder to compare his performance with a norm and will allow him to tell, at any time, how much work he has yet to do. Tools: We have also received many inquiries about the tools required to build the Eze. Most tools are of the common tool box variety: screw driver, wrenches, saws, hammers, etc. This is a short list of the special tools: hot wire saw (homemade using safety wire and an auto battery charger), moto tool dremel or weller home shop hand grinder, X-acto knife, epoxy ratio pumps or balance, tongue depressors, surform file, scissors and butcher knife. A band saw (wood and aluminum cutting), small sander and a drill press are nice but not required.

Starter: OK, you guys who insist on installing an electric starter, look at what you're doing to your airplane. First, you add a 16-lb starter to your engine, then add a 25-lb battery in the nose to balance and power it, then add six pounds of cable to connect the two (both ways - You can't ground to glass and foam). Presto, you've added 40 pounds of empty weight that does nothing except in the first five seconds of a flight. A small seven-lb battery gives you everything you need for avionics and lights. For the privilege of pushing a button once each flight, you have reduced your useful load carrying ability by 10%. Look at it this way, your starter equipped airplane will go 330 miles less with the same takeoff weight as my hand-propped model.

VARIVIGGEN PLANS CHANGES

Be sure to incorporate these revisions into your plans now.

Location PL - Plans
TR - Tech Report
NL - Previous Newsletters
CAT - Catalog

Category of Change
MEO - Minor error or omission
OPT - Optional improvement
DES - Desirous change; does not effect flight safety but should be incorporated to improve aircraft or correct a fault.
MAN - Mandatory change; must be incorporated as safety of flight is affected.

Category	Location	Change
MEO	PL pg 41, pg 57	RP1 sketch - Tube size 5/16x.035 not 5/16x.063 for AN4 bolt.
MEO	PL pg 40	Change AB belcrank rivets to -15 not -9 as shown.
MEO	PL pg 30	Aft end of OW2 sq. tube should be welded closed or filled with a phenolic block.
MEO	PL pg 15	C1 is under size to mate with CR. Either file CR5 down to match C1 or make C1 over size to match CR.
MEO	PL pg 47	16.7 dim should be 16.2 on MG14 detail.

SP WING PLANS

As we mentioned in newsletter six, the special performance wing plans are ready for mailing. The plans price of $39.50 (Calif. residents add $2.37 tax) includes plans and a very complete construction manual with instructions so detailed, that they may insult your ingenuity! The plans include full-size rib lofts, composite rudder, and winglets. The construction manual includes photos.

A number of builders have asked us if the composite structure of the SP wing can be used on the standard wing. We don't recommend anything for you that we haven't flown ourselves, but, we don't see any reason why the information in the SP plans, together with the lofts and information in chapters 3 and 10 of the standard plans couldn't be used to build a set of composite panels for the standard airplane. The composite wing would be a stronger wing than the metal wing. Since the ailerons on the standard wing are larger than the SP ailerons, the hinges for a composite standard wing should be 10 inches long instead of 6 inches long. The addition of winglets to the standard wing should also improve it's performance, more so, than the SP wing because of the lower aspect ratio.

Since we had the SP plans printed, we have developed an optional aileron (or rudder) hinge stiffener plate which replaces the plywood parts and screws with a sheet metal angle as shown in the sketch. This method makes the aileron (rudder) to wing (stab) fit up much easier. To install, remove a 1/8" gap of foam, 1-in deep adjacent to the skin, bend the .020 alum AA7 angle to fit flush along the foam face and

against the hinge. Hold in place while drilling holes through the skin, hinge, and AA7 for rivets. This can be done on both sides at once with the aileron in place on the wing. Use clecos to hold the hinges while drilling. Remove the hinge and AA7, fill the gap with flox and install the hinge (one side at a time with the hinge pin removed) using pop rivets. The glass skin on the vertical face should be applied now to give a wet bond with the flox used to mount the hinge. **SKETCHES OMITTED**

VARIVIGGEN BUILDING TIPS
Jim Cavis moved his MG9 pulleys outboard 0.15" as suggested in newsletter 4 to use the shorter MG4 beams supplied by RAF. With the new location for the pulley, Jim found it to be advisable to bend the uplock belcrank inboard and put the bolt on the outside (see photo). The photo also shows the fairlead pulley on the aileron cable to provide additional clearance with the gear parts. If you have the short MG4 beams, you may find that its easier to weld a strip of steel on the end to extend them to the plans dimension rather than move MG9.

Jim also cut a 2-1/4" dia hole in F152 above the MGMA to aid in the installation of the MG42 spool and so he can see the MG42 spool in action. He reports the entire gear is now complete and operation is satisfactory.

It is possible to get the cables forward of the spar instead of in the close quarters behind F152. I did this on N27VV with pulleys as shown in the sketch. You can use this method if you wish to have better access to the cables and turnbuckles. I don't think the extra complexity of pulleys and brackets is worth it though.

Jim reports it took six people and a case of beer to turn his Viggen over after skinning the bottom: sounds like an overkill to me!

SKETCH OMITTED

Orv Winfield reports that auto parts stores carry what they call a "tank valve" - a tire valve with metal 1/8" pipe thread. This should work fine on the nosegear strut. He paid 56 cents for his.

Several builders have reported difficulty with warping when welding NG15 to NG13. This can be avoided by welding a small ring of .063 steel to the tube and bolting on NG15 with six #8-32 screws (see sketch). **SKETCH OMITTED**

When cutting WR25 it is not necessary to cut the notches for Spar H and I. Spar H and I do not have to pass through WR25; adequate support is provided by WR24.9 ribs. Thus, fitting the notches is not necessary.

Landing gear motor assemblies - The accompanying photos show the assembly used by Pastor Bruce Jenkins. He hinged the motor (a Ford part number DOAZ-5723395-A) from the opposite side and supported it with a 'u' channel fit to the motor housing. It mounts firmly over the F30 fitting on the left side. The large plate is .125 alum. The large

gear is a Boston ND64. He used a similar setup on the nose gear with a Boston ND30. These gears mesh directly with the Ford unit.

Ken Guscott went one step further and built a rigid box to house the large gear providing bearing support on both sides. He also uses a relatively complex system to provide lateral disengagement for emergency extension. While a bit on the complex and heavy side, his system is well engineered and should provide excellent operation. He has made up a full-size drawing of the system and will distribute it to other builders at a nominal cost for reproduction. He also has a drawing for his homebuilt nose gear designed around a surplus shock strut. His address: 12 Richards Road, Lynnfield, Mass. 01940.

VariViggen Hydraulic Brake Line Routing:
As shown on plans page 41, flexible line runs from the master cylinders to a bulkhead fitting through F31. Half hard (5052-1/2H) 1/4 O.D. aluminum line is run from this fitting inside the nosegear box through F32 aft along the side (inside) the tunnel. The aluminum line is routed aft to Spar B then outboard along the front face of Spar B to another bulkhead fitting mounted on WR46.

Route the aluminum line through Spar B at B.L.45 and W.L.3. From the WR46 fitting a flexible line is run aft about 6" then looped forward and down the shock strut to the brake. This leaves a loop of flex line outboard of the gear door cutout. Check for chafing of the brake lines during gear retraction. **SKETCH OMITTED**

Asbestos fiber that we at one time recommended as an epoxy thickener has been identified as a possible health hazard if you breathe the dust. We no longer use it at RAF and don't recommend that you do either. As a non-toxic substitute, we recommend flocked cotton fiber (Gougeon Brothers 403 fiber).

The following sketch shows the battery location first used in N27VV. Note that the long dimension is positioned fore-aft to give room for the nose gear in the retracted position. I later moved the battery to between F70 and F91 after adding other equipment and finding that I didn't need the nose weight. Each builder should mount his battery after the first weighing to determine the optimum position for his aircraft. **SKETCH OMITTED**

VariViggen builders now total 440. Those of you with a VariViggen aircraft serial number will find enclosed with this newsletter, an update to the builders list.

f you can't find the 1/2" sq alum tube for the canopy, substitute 1/2x.049 2024 T3 or 6061 T6 round tube and use larger corner gussets and three extra rivets into the tube at the corners.

SHOPPING
We've heard reports that some suppliers have charged nearly twice the going or promised price on items which were ordered. We suggest that

you get a price quote and a promised delivery before ordering anything from an unfamiliar source.

Ken Brock Mfg., 11852 Western Ave., Stanton, Ca. 90680 is manufacturing the light weight fuel cap assembly for the SP wings and they are available now. Ken has a beautiful illustrated catalog for $1.00, unfortunately the fuel caps were too late to be included.

Bill Campbell, S/N 325, Bx 253, Phelan, Ca. 92371, phone 714 249-6218, is manufacturing the following parts for VariViggen builders: C8, C9, C12, C14, C16, C18, C19, C21, C15, EC3, EC5, E6, F29, F30, WF45, WA1, R11, AA3, SA4, SA5, SA8, SA9, SP5, PA5, PB2, PD2, AB2, AB3, AB4, AB8, AB12, AM2, RB2, RB3, PF2, PC2, EM2, NG11, NG16, NG17, NG19, NG21, MG8, MG9, MG10, MG20, MG22, MG24, MG29, and a 30-gallon fuel tank that fits in to the standard space. For prices and availability, send a stamped self-addressed envelope to Bill. Having these completed parts can really speed up your construction project.

Flight Test Assistance - We are planning to provide a pre-first flight inspection and initial flight test assistance service for our builders. This would involve us visiting your flight test area, giving your aircraft a very complete inspection and rigging check, prior to first flight and either flying your first flight or checking you out in N27VV to improve your proficiency for your first flight. Providing flight test assistance in expanding the flight envelope of your airplane would also be very beneficial in assuring flight safety. This service will only be provided to those who are building the airplane without major modifications from the plans, and flight envelope expansion on your aircraft will be limited to the envelope shown in the aircraft operating limitations, plans page 3. We will provide this service to the first three builders who complete their aircraft, free of charge except for transportation costs.

National Scientific Co., P.O. Box 901, Melbourne, Fl. 32901 is offering a kit for a capacitance fuel gauging system that promises to be lighter and more accurate than the float type gauge. The FG15 kit price is $43.40.

Pastor Bruce Jenkins, S/N 177, Rt 1, Eagle, Mi. 48822 has two Continental 0-200 B engines with accessories, currently undergoing chrome major, for sale. These engines will be available for delivery in mid March. A certified check or money order for $2150 will hold one for you.

Australian and New Zealand builders, who need a certified epoxy, contact Consolidated Chemicals LTD, New Zealand for information on their product "epiglue."

Gougeon Brothers, 706 Martin St., Bay City, Mi. 48706 has a hand cream for epoxy workers that enables you to clean up with soap and water only. You can order this barrier skin cream (ply no. 9) for $2.60 a one-lb jar.

We've heard from several builders that G & J Aircraft and Industrial Metals, 1115 S. Sultana, Ontario, Ca. 91761 has good prices on hardware and metals.

George Evans, 4102 Twining, Riverside, Ca. 92509 is pumping out welded assemblies for VariViggen builders. George has added the NG25/26/24/23/27 assembly with an adjustable NG27 to his stock and they are available now. George also has MG14's, MG32's, and EM1 weldments. You guys who have had trouble finding 1-1/4-in square tubing just write to George; he has 1000 ft of it fresh from the mill. George has also become a distributor for the Scott tailwheel ass'y and he's offering them below retail for VariViggen builders ($186.). All of George's products that we've seen, have been of excellent quality and workmanship.

Vernon Williams, S/N 189, 4 Southmont Cir., Little Rock, Ark. 72209, reports that he still has a fuel tank for sale of the type he had at Oshkosh.

Those of you that are still having trouble locating materials, should get an Aircraft Spruce & Specialty catalog. This outfit provides excellent service and has a very complete "in stock" line of everything from plywood to hardware and instruments. One builder noted that their precut VariViggen spruce kit (certified spruce) was cheaper than buying spruce from his local lumber yard. Their address is Bx 424, Fullerton, Ca. 92632. Catalog cost of $2.00 is refundable on first order.

Jesse Wright, S/N 91, is in production with his canard kit, having delivered the first half-dozen or so. Jesse is also manufacturing a bulkhead kit. If you're interested, write directly to Jesse Wright, 7221 S. Colorado Ct., Littleton, Co. 80122. His canard kit is priced at $116 including packing and shipping (in the U.S.A.). We listed Jesse's phone number incorrectly in newsletter 6; it is 303 771-5140, not 711-5140 as shown.

RAF is no longer handling the VariViggen bulkhead and rib kits. We do have a couple of sets here that we can sell at a discount to anyone who would like to pick them up at Mojave - we're no longer equipped to ship them. If you still want the bulkheads and ribs drawn on plywood, (not routed out like Jesse Wright's kit) you can order them from Aircraft Materials Co., 850 E. San Carlos Ave., San Carlos, Ca. 94070. Write them for price.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Bruce Jenkens' maingear motor assembly with gearing.

VariViggen radio-controlled model built by Bob Constance, Tempe, AZ.

Bill Campbell's shop looks like an assembly line. He's building two!

New communications & navigation antennas from H. C. Communications.

Jim Cavis' maingear actuator assy.

Jim Cavis' fuselage gets a half-roll after skinning.

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NEWS OF THE VARIVIGGEN AND VARIEZE PROGRAMS
(very vig-in) (very easy)

NEWSLETTER SUBSCRIPTION - $4.75/yr
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BACK ISSUES - $1.00 each

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

N4EZ with 3rd generation inlet airscoop. Scoop has since been made smaller.

Hand propping is VariEze and requires no chocks or tiedowns. Rubber bumper on nose is better than a chock.

Ground handling is VariEze.

Panel on prototype - see text for other layouts. Note the stick and throttle quadrant - these will be offered as "ready to bolt in" parts.

RAF ACTIVITY since our January newsletter (no. 7) has been hot and heavy. We've spent considerable time refining our composite construction methods (VariEasier), conducting structural tests, and flight testing the Continental-powered VariEze, N4EZ. In addition to supporting our VariViggen builders and writing the Viggen owners manual, we've been burning the midnight oil releasing VariEze manufactured items and materials for production and working on the Eze plans. Regrettably, we've also spent a full third of our time answering letters and telephone calls from people requesting a personal Eze program update. We know that you folks are excited about the program and we really appreciate the interest, but please save your dime so that we can get the job done! Once we have the plans done, we'll gladly answer all of your questions. Until that time, we must ask you to leave us alone so that we can work. Preparation of the manufacturing manual for the Eze homebuilder is a very big job. It can be completed by late May if we can reduce the interruptions. You are welcome to visit us from noon to 2 P.M. any Saturday for our weekly demo, but don't come during the rest of the week. We cannot show you the airplanes during the week.

In the last few weeks during the Saturday afternoon demos, we have been giving composite construction demonstrations. We will continue these construction demos to give our Saturday afternoon visitors a first-hand

look at the method used in VariEze construction. Flight demonstrations will not always be given on the Saturday demos since we plan to take the VariEze and VariViggen to several flyins this summer, including Corona, Watsonville, and Oshkosh. We will plan to have a construction demo set up though for any Saturday visitors.

VARIEZE DEVELOPMENT FLIGHT TESTS - The prototype for the homebuilt program (N4EZ) made its first flight on March 15. As of this writing (15 April) it has logged 35 flight hours. The test program has progressed very well to date, the aircraft being in flight-ready status essentially all the time. There have been a number of changes required as a result of the tests. These are all covered in the following:

Flying Qualities - The aircraft initially had poor harmony between the pitch and roll forces - pitch too light and roll too heavy. We made two gearing changes in the control system (different length arms) to tailor the forces to what is now considered optimum. Pitch forces are now about three to four lb per g, which is just about right for a side stick control. Roll rate without rudder is slower than the average light plane, but when coordinated with rudder, the roll rate is more than adequate at all speeds.

Hands-off stability is better than the average light plane. Trimmed up, it will hold altitude and heading, even in turbulence, without touching the controls. I recently flew a 3-1/2 hour flight, while touching the controls only for about 10 minutes - take off and landing. Turns were made by leaning in the cockpit and the aircraft held altitude between 10,500 and 11,000 feet for three hours.

Dynamic damping is dead beat in pitch and roll and one-overshoot in yaw at all speeds. The phugoid damps in one cycle, which is quite good for a clean, fast aircraft. There is no pitch or yaw trim change due to power changes. There is a roll trim change, and we have verified this to be due to direct engine torque, not aerodynamic effects. It was not significant on the VW powered aircraft, since the torque is low on the 60-hp, high rpm engine. The difference of roll trim from full power climb to idle descent is enough to be a nuisance, so we added roll trim to the aircraft. This is a small tab (1 1/2"x10") at the wing tip, actuated by a model airplane servo. This "separate surface" trim is preferable to elevon trim since it does not effect elevon authority and is a handy inflight adjustment for any wing twist tolerances.

Stalls in the VariEze can best be described as 'boring.' The design of the two wings are such that the aircraft is self-limiting to about 14-deg angle of attack. The technical reasons for this are beyond the scope of this discussion, but the result to the pilot is as shown in the accompanying graph. A normal relationship of elevator position required to hold airspeed (or CL) exists up to about 12 degrees angle of attack, which corresponds to about 52 knots or CL=1.5. This is also about the angle of attack of maximum CL of the canard surface. As the stick is brought further aft from the 52-knot position, the pilot notes four things: 1. It takes a lot more stick motion to get just a little slower speed and full aft stick is reached in a nice stable flight condition at 48 knots (CL=1.66). 2. There is an occasional mild pitch bucking motion below 50 knots, but no g-break, yaw, nor roll motions. 3. Power required to fly level is not greatly increased (I was climbing at 14,000 ft, 48 kt, and 1/3 throttle!). 4. Roll control with the

ailerons begins to degrade below 52 knots, however the airplane is VariEze to fly with the rudders at any speed, including full aft stick (48 kt). At 48 kt the airplane cannot be rolled with the elevons (somewhat like a Cub near stall). **GRAPHS OMITTED**

Tuft tests show excellent attached flow on the vertical fins at all speeds, and some trailing edge local turbulence near the wing tips and canard below 50 knots.

Accelerated stalls are similar. We don't know yet if the VariEze will spin, but we do know an even more important fact: it is much less susceptible to inadvertent spins than the common light plane.

The independent rudders move a total of about 50 degrees which makes them effective as speed brakes. If you're high on final approach, the rudders can be extended to add about 200-ft-per- minute rate of sink.

The overall flying qualities can best be described as "comfortable." Certainly not aerobatic, due to the low roll rate, but excellent for its primary mission: travel from point A to point B with little fuel used, and at a high cruise speed.

Performance - The following performance data are from flight tests with N4EZ. They are based on a plans-built aircraft with wheel pants. All data are for a fixed-pitch cruise prop except for the 65-hp engine - we are recommending a climb prop for the 65-hp installation to improve take-off performance, at a 10-kt cruise penalty - this is why the 65-hp take-off and climb performance is the same as the 75-hp data. **GRAPH OMITTED**

VARIEZE PERFORMANCE GRAPHS OMITTED

MISC VARIEZE DEVELOPMENT ITEMS

Cooling - N4EZ overheated on its first flight. The original cowl inlet was designed more for low cost production than for pressure recovery. We instrumented the high and low pressure plenums and built a large, ugly scoop for the bottom. This gave more than adequate cooling, but resulted in a five-kt drag penalty. We then built the 65 square inch inlet shown on the pictures in this newsletter. It gave a 3-kt speed increase and still cooled as well. Since the pictures were taken we have reduced the inlet to about 42 square inches and have found this to be optimum for the 100-hp engine. Cruise temperatures are oil=170 degrees F, cylinder head=360 degrees F, both well in the green. Concerning the inlet, different inlet areas will be required for the different hp engines. To keep the cowling price low, we plan to offer the basic shape and have the homebuilder build up a foam/glass lip as shown, to match his engine size. We now also know that the outlet area is too large and that some more performance can be gained by a better cowl/spinner fit. However, we feel that it is much more important to get the plans our first, rather than spending the next two weeks going after four more knots speed. Therefore, we are not going to change the outlet until after the plans are out. This means that the cowlings will not be available until about two months after the plans are out.

This will assure you of an optimum cowl, without us delaying the plans. **SKETCHES OMITTED**

Engine Installation - All aspects of the Continental engine installation have worked out excellent. The simple homebuilt carb heat box is mounted on the airframe, free from engine vibration. It mounts on an automotive-type air filter which is much more effective than the average aircraft filter. Induction system losses and mixture distribution is equal to the best systems we've seen. The carb heat muff is a very simple two-piece, easily built part that provides a 90 degrees F temperature rise using only the left exhaust system. This leaves the right side available for a simple cabin heat system. However, as long as the aircraft is flown day-VFR, a heater is not required - the canopy traps radiant heat that is held by the foam-insulated fuselage structure. We are using a low cost exhaust system with a homemade glass-pack muffler. The lightweight muffler removes most of the engine noise, the remaining noise being mostly from the propeller. The VariEze cockpit noise level at cruise is about like a late model Cessna, allowing conversation at a normal voice level. Absolutely no indication of any problem has been seen with the pusher thrust bearing, using the tractor engine (see newsletter 7). Crank end play shows no wear and case temperatures are normal.

Pitch Trim - Pitch trim initially was done by a handle that operated a spring, connected to the stick. After we changed the pitch gearing, the trim loads were increased such that it was difficult to precisely trim the aircraft. We then changed the handle to a 1.5-diameter knob that the pilot turns for pitch trim. The result is a precise trim system that has fewer parts and is easier to build. The obsolete handle is in the panel photo in this newsletter (pg 1).

Nose Gear Retraction - An important design feature of the VariEze is its retractable nose gear with capability powerful enough to raise and lower the nose on the ground with the pilot and passenger aboard. This allows the aircraft to be parked in a very stable attitude on the ground, "chocked" for starting the engine and allowing easy pilot entry and exit without a ladder. Development of this feature, however, has been a very difficult and frustrating experience. N7EZ had a simple-concept system as shown in the sketch, using a recirculating-ball screw assembly to provide low friction. The system allowed the pilot to crank himself and a passenger up and down, (33 turns) but if he let go of the handle in the process, it would spin wildly around and let the nose down hard. **SKETCHES OMITTED**

I didn't like the system, primarily because the ball screw assembly was expensive. We used the same concept on N4EZ, but replaced the ball screw with a lower cost Acme screw threaded rod, hoping that the extra friction would solve the spin problem. We found that even with a 45-turn gearing, the system would bind up under load, requiring a heavy two-handed effort to crank the nose up with the pilot in. We installed an electric auto window motor which works okay, but takes 35 seconds for gear retraction, requires an electric system in the airplane, and costs over $50 just for the motor. This, of course, was not the most satisfactory approach. Sometimes it is best to back off and look at

the forest instead of the trees - I did, and realized the basic problem was that the hand is very inefficient in turning a small crank with the arm in line with its axis of rotation. The most efficient manual capability is an aft pull of the arm, using the biceps muscle. We found a low cost jack-type mechanism that can be installed and easily rigged to allow gear extension/retraction with 10 pulls of a D-ring handle mounted on the instrument panel. This should allow a much faster, easier to build, much lower cost gear transit system. We are now installing this system on the VW-powered prototype, N7EZ, for testing. Incorporating this change will, of course, cause some delay but that's what our type of business is about. If we knew exactly how everything would work, we wouldn't even have to do flight testing!

Static Test Wing - Our static load test wing is completed and will undergo proof-load tests soon. After proof load testing the wing will be given to another organization for fatigue testing. The glass layups on this wing were done by an aviation writer who had no previous fiberglass experience. He was curious if he could do the work and we wanted a first-hand look at how well a beginner followed our wing plans. His work looked fine to us and he was pleased with the ease of construction.

VARIEZE WORK AREA AND TOOLS
Shop Size - Of course, a nice roomy 20'x30' work shop is ideal, but a VariEze can be built in an area as small as a single-car garage (10'x18'). The new epoxies used are less toxic and have less odor than contemporary ones, but we still strongly recommend a well ventilated work area. If you are considering a stuffy basement, rig up a small ventilation fan to move out fumes during the glass layups. The temperature of the shop must be maintained between 60 degrees and 90 degrees F during the glass work, 75 +-5 degrees being ideal.

Table to Jig Wings and Canard - This is any relatively flat surface at least 10 ft long x 2 ft wide. Any larger than 4 ft by 12 ft will just get in the way. The sketch shows the one we built and it works fine. The box design makes it stiff in torsion. Don't get carried away with surface finish: you will be gluing jig blocks to it with Bondo and chiseling them off several times. Set it up with the top 34 to 39 inches above the floor. **SKETCH OMITTED**

Tools - There are certain tools required to build a VariEze. Three lists are provided here. The first one is the absolute minimum required, sacrificing efficiency; the second is a recommended list for a good compromise of cost and work efficiency; the third is a list for the "Cadillac" of shops, where ease of construction is more important than money. Don't call us now asking how to find the odd-ball items. These will be available where you buy VariEze raw materials.

1. Basic Minimum: Common household butcher knife, coping saw, pliers, 1/4' drive socket set, set of small open end wrenches, 1" putty knife, hacksaw, screwdrivers, box of single-edge razor blades, 24" carpenters level, carpenters square, 3-ft straight-edge, 12-ft steel tape, 1/4" drill, roll of gray duct tape, box of 1" and 2" paint brushes, several 6" plastic squeegees, scissors, wire brush, pop rivet puller.

2. Recommended (in addition to #1): Dremel-type miniature high speed hand grinder (set no. 261 is okay), 1" and 1/2" chisels, small set of

X-acto knives and razor saw, stipple roller, 100-deg. countersink, 6" steel ruler, 6" to 9" disc-type hand sander, saber saw, Stanley surform plane, square and half-round files, several 6" C-clamps, vacuum cleaner.

3. First class shop (in addition to #2): Drill press, bench mounted belt sander, 18-inch band saw, epoxy ratio pump, 90 degrees drill adapter, air compressor with blow nozzle.

4. Items used only occasionally and can be borrowed: Nicopress sleeve swage tool, 12-volt battery charger for hot wire cutter, one dozen 1/8" clecos.

VARIEZE MATERIALS - It still looks like the materials cost (less engine) for the Eze will be about $1300 for those willing to build everything. If you buy all prefab parts that will be available (landing gear, axles, engine mount, rudder pedals, stick assembly, elevon pivots, wing attach fittings, fuel caps, canopy, cowling, etc.) the cost, including all raw materials and instruments, should be about $2600. You can pick any number between these values, depending on how much you want to build.

Our distributors are already stocking most of the items. The manufacturers have already built several hundred of many of the prefab parts. We expect that all raw materials, tools and prefab parts (except cowling) will be available in quantity when we release plans. We will identify all distributors in newsletter 9 and in the plans.

VARIEZE PLANS - We really don't like to call them plans - a better description would be manufacturing manual. They include a 30-page educational section that gives you a very complete introduction to the materials and detailed methods used to build the VariEze. The plans themselves are not just engineering drawings, but a very complete step-by-step manual showing each operation required. If you're curious about the format, find one of your wife's Simplicity dress patterns and look at the instruction sheet that comes with the pattern. We have found that this format of words, photos, and sketches, to supplement the normal drawings, is a very effective approach. Each major job is detailed and in each step you are told how many man-hours should be required.

The basic plans will consist of about 150, 11"x17" sheets, plus some larger full-size drawings. The plans will be offered in several sections:

Section I - Composite structures education, construction manual and drawings on entire aircraft except engine installation and optional electric/avionics systems.

Section IIA - Continental Engine installation. Complete instructions and drawings for 65 to 100-hp Continental engine installation: baffling, fuel system, mounting, exhaust system, carb heat system, engine instrumentation, cowling installation, propeller and spinner and engine operating specifications.

Section IIB - Same as IIA except for aircraft conversion of the Volkswagen engine.

Section IIC - Same as IIA except for alternate engine.

Section III - Electrical/avionics: drawings, specifications and installation instructions for optional electrical system, night lighting systems, avionics and antennas, and instrumentation associated with electrical system.

Section IV - Owners manual: flight and maintenance manual for the VariEze similar to the VariViggen owners manual. Includes normal and emergency procedures, loading graphs, operation checklists, detailed flying qualifies descriptions, performance charts, maiden flight test procedures, pilot checkout procedures, maintenance checklists and a record keeping section.

So, if you want to build a basic VFR VariEze with a Continental A-75, and without electrical system, you will need sections I and IIA and then section IV before your aircraft is ready to fly. If you insist on loading your aircraft up with avionics and lighting, you can get section III. Section IIB should be available as soon as the VW engine installation is completely proven out, possibly within three months after section I is released. If you want to use a VW conversion, you can get section I, start building your aircraft and then get section IIB when its ready. Section IIC is being pursued now, because it is obvious that the supply of used 4-cylinder Continental engines will be quite short within about two years. As these engines start getting scarce it will be important to have an alternate engine to keep the VariEze program alive. There are actually four different engines now being considered, all in the 80 to 90 hp range, light weight, and relatively low cost. These are being developed by other organizations; RAF does not plan to undertake engine development. But, don't get excited about getting these real soon. Aircraft engine development is a very big and expensive job and, while I have every hope of getting an alternate engine soon, I think it will be about a year until one of these "new" engines proves adequate. Do not contact us to consider any engine you may have in mind, unless it has at least 800 hours of reliable flying time.

Now for the big question - when will the plans be ready?? They are now more than half written and laid out. We have been, and will be, working days, evenings and weekends on the plans. We think they will be done in late May. The new nose gear extension system may delay this, but we don't think by much. Due to our policy of not selling anything we don't have, we cannot let you order plans at this time. We do have a plan to notify all subscribers of "The Canard Pusher" when they are available: as soon as we take sections I and IIA of the VariEze plans to the printers for printing and binding, we will immediately write newsletter 9, in it giving all information for ordering the plans. Thus, "Canard Pusher" no. 9 may be published in early June, giving you firsthand notice of plans availability. So, please do not call or write asking when they will be available; we will notify you as they go to the printers.

Initially, we do not plan a large promotional campaign to advertise VariEze plans. We want to wait until a few months after the plans are on the market to be sure the distributors are keeping up with demand on the raw materials and prefab parts. Our announcement of plans availability in newsletter 9 and in "Sport Aviation" is our only planned initial promotion.

CONSTRUCTION SEMINARS/AIRSHOWS - Due to the uncertainty of exactly when the plans will be finished, we cannot schedule specific seminars now. Newsletter 9 will announce any seminars we can schedule by then. We do plan a daily construction demonstration in the synthetics workshop at the Oshkosh, Wisconsin EAA convention. VariEze forums at Oshkosh this year have been scheduled for Monday, August 2 and Thursday, August 5. A VariViggen forum will be Wednesday, August 4. We plan to have the VariEze and VariViggen at the Corona, Ca. (1 & 2 May) and Watsonville, Ca. (29 & 30 May) flyins.

VARIEZE QUESTIONS

ATC Radar - I'm not sure why, but the VariEze is picked up on Air Traffic Control's radar similar to light planes built from metal.

Ultra Violet Protection - While glass needs no protection, the epoxy and foams do require an UV barrier to protect against long term degradation in sunlight. A UV barrier is sprayed on before final color paint. All finishing materials required and methods to get that "competition sailplane" contoured finish we put on our airplanes, will be published in a booklet "Finishing the Composite Homebuilt Airplane." This booklet will be available this summer - it is applicable to any aircraft with an epoxy/fabric exterior.

Very Low Temperatures - Several people have asked how the structure withstands the low ambient temperatures common to the North. I think this concern stems from thermal stress failures that have occurred on another homebuilt that has a relatively weak surface skin and a highly insulated main spar. The VariEze structure bears no resemblance to that structure - spar caps and skin being at the surface minimizes thermal stress. The glass/epoxy matrix actually has improved physical properties at low temperatures. These same materials are used in structural areas of military aircraft whose high altitude envelopes requires them to be qualified to below minus 70 deg. F.

Instrument Panel Room - The accompanying sketch shows three different instrument panel layouts. The first one is what we recommend for the VariEze - a low cost, lightweight panel for high performance day VFR utility. A com radio is needed to get any cross-country utility now days, but the rest is bare bones, giving more leg room. The other two layouts show the capability to stuff different type equipment in, for those who like to gaze at clocks. **SKETCHES OF INSTRUMENT PANEL LAYOUTS OMITTED**

Closure Inspections - When does FAA inspect the structure? The glass is applied over a solid foam core - thus there is nothing to inspect before skinning. All joints and all structure is inspectable from the

outside, and must be done after the structure is built but before it is painted. You will be given specific inspection criteria in the plans. In addition, since not every FAA inspector is familiar with composite structures, we plan to supply recommended inspection criteria to all FAA regional offices and to the foreign agencies.

Suitcase Size: Two suitcases, size as in sketch, fit into the back seat area on the sides up against the front seat. When empty, they take up little room. When full, they take up some of the lateral (sideways) leg room of the back seater. These suitcases will be available in completed form from VariEze distributors. In addition the Eze has two map cases (under front seat thigh support and in roll-over structure) and baggage areas behind the rear seat and in the center section spar. **SKETCHES OMITTED**

Prop Sizes - We have tested four different propellers, including a three-blade. We plan to test at least two more before we finalize the prop specification.

80-Octane Gas Availability - Continental engines offer a conversion to all the 65 to 100-hp engines that allow continuous use of 100 octane low lead gas. This kit can be installed at top overhaul.

Foreign Country Homebuilt Approval - We have received requests for assistance from New Zealand, Australia, Canada, and England to provide the engineering documentation required to gain approval for amateur building. We intend to supply all these requests for stress data and static test documentation, but we must wait until after the plans are out.

Other Questions?? Each newsletter we try to answer the questions sent to us which have not been answered in previous newsletters or the information kit. If your question needs and deserves an immediate reply, please include a self-addressed stamped envelope.

VARIVIGGEN PROJECT REPORTS - Only three projects reported since January. Let's hear from the rest of you!

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Mike Melvill's mount & firewall. Note the cabin heat control box at the bottom.

Mike Melvill's, SN 115, 1st class cockpit! Note engine instruments in lower center, radios at right console. Any fighter pilot should feel right at home!

This VariViggen being built near Toulouse, France will be powered by two Microturbo jet engines (200-lb thrust each). It is being built in co-operation with the engine manufacturer as a flight test article for engine development. Expected take off and climb will be similar to a 150-hp VariViggen. Cruise should be about 190 mph: range, only 250 miles on 50 gallons!

N31VV, by Jim Cavis, SN31: All work done except canopy and outer wings.

Glass/foam composite rudder and engine mount on Jim Cavis's VariViggen. The dynafocal mount is available for $180 from Star-fire Aviation, 4225 S. 37th, Phoenix, Az. 85006

VARIVIGGEN BUILDER TIPS

Those of you with dynafocal mounts may find an interference with the cowling at the mount point. The following method is an easy way to put a streamlined "blister" on the cowl anywhere you need more room. **SKETCHES OMITTED**

Tension on the aileron control cables should not be real tight. Proper tension is only 10 to 15 lb. Adjust the turnbuckles to take out the slack, then tighten about two turns for a light snub - exact tension is not critical.

You may want to carve the center notch on F20 up higher than shown on the plans to allow the nose gear to go further up and hold more securely in the up position.

The Gougeon Brothers brochure recommends three coats of epoxy to protect wood surfaces. This is for boats! Three coats are too heavy for your airplane. Paint one full coat to interior surfaces. Finish the exterior as shown in newsletter 6.

We understand from Jim Saunders, SN 396, that some manufacturers of wood props are hesitant to build a wood prop for a 180-hp Lycoming unless the builder supplies a spacer to provide a larger bolt radius for the prop. While it is completely satisfactory for the 150-hp Lycoming, they are concerned about the bearing strength of the wood on the short lugs used on the 180-hp engines. This may or may not be a problem. If anyone knows of any problems with a 180-hp wood prop, let us know. Actually, the primary torque-transmitting surface is friction between the flange face and the prop face. If you don't believe this, run your engine with loose bolts so all the torque is on the lugs - they will fail within a few minutes running. Just kidding, of course, about doing this - Never run an engine unless you're sure the bolts are properly torqued. After installing a new prop, retorque after the first run and each 10 hours until it sets in well. Recheck torque each 100 hours. Proper torque for a prop (with a hub depth of 4" and 3/8" bolts) is obtained after the bolts take out all slack and are then turned one more full turn. This provides the correct percentage squash of the hub. If you're using a 180 hp engine, contact your prop manufacturer about prop installation.

VARIVIGGEN PLANS CHANGES

Plans page 11 and construction manual page 10 - Install F3 before F5.

VARIVIGGEN SPECIAL PERFORMANCE WING

The VariViggen owners manual gives a detailed discussion of the performance and flying qualities differences between the standard and SP wings. If you can't decide which wing you want to use, check your owners manual.

Jim Cavis is building the standard shape wings with the glass/foam composite SP structural method. RAF is working with Jim on the design details of this modification and on sizing winglets for the standard wing. The results will be passed along in following newsletters or the 2nd half of the construction manual. Jim has finished the glass/foam rudders. His report: "Construction was done in two days, mostly waiting for one side to cure so the other could be skinned. I really had fun with the new method of yours - put me on the list for some EZ plans!"

BUILDING TIPS FOR THE SP WINGS
The best way to leak-check your fuel tanks is to plug the vent and hook a standard altimeter to the feed line. Suck or blow a 3000-ft pressure difference and check that it can hold pressure for 24 hours. Do this before cutting the tank cap hole.

The two yellow sheets of the SP plans are printed on card stock paper. This is so they can be tacked to your shop wall for easy reference for the glassing methods. We feel the stippling action (step 6 on the yellow sheets) needs more emphasis since, on a given layup, about 1/2 of the time is spent stippling. Add the following words: Where multiple plies are required, the first plies may be laid up overly wet and the excess resin brought up by squeegeeing and stippling to help wet out the middle plies. The final plies are ambitiously stippled instead of adding a lot of resin. "When in doubt - stipple." Don't hesitate to stipple after squeegeeing. If you use care to not apply too much excess resin, you can do the entire layup with stippling and no squeegeeing.

When bonding the large blocks of foam with wet micro it is possible that the insulation of the foam will not let the epoxy heat escape and an exotherm can occur down in the middle of the joint. This exotherm can be hot enough to melt the foam locally and weaken the joint. We have formulated a special long pot life epoxy for the VariEze to avoid this problem. This epoxy will be on the market when the EZ plans are out. In the mean time, if you are joining large blue foam blocks using Shell epon/teta or Gougeon 105/206, you should do the bond at an ambient temperature of 65 degrees or less. This will prevent the exotherm.

SHOPPING
See the back page of this newsletter for VariViggen parts and materials. Note that RAF no longer handles any parts. You are referred directly to the manufacturer for the VariViggen machined parts. We, of course, will continue to help builders on installation problems with parts obtained from RAF distributors.

Pistol grips with switches - R. Williams tells me these are available at Goff Aircraft, 8131 E. 40th, Denver, Co 80207, but their price ($38.50) is much higher than you need to pay, if they are still available on the surplus market. Anyone know where these can be found?

The following sketches of the VariViggen exhaust system and heat muff have been previously included with the cowl installation instructions.
SKETCH OMITTED

Canard Pushers from 1 to 82

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THE CANARD PUSHER NO 9 JULY 76

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NEWS OF THE VARIVIGGEN AND VARIEZE PROGRAMS
(very vig-in) (very easy)

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RAF ACTIVITY since newsletter 8 has, again, been hot and heavy. All flight tests and ground tests for the VariEze were completed on May 20. The massive job of preparing and laying out the VariEze manufacturing manual was done on a six to seven-day week, 10 to 16-hour day schedule. The basic manual (section one) was delivered to the printer on June 15. We are currently on the same type of busy schedule, trying to complete the owners manual (section four) and the Continental engines installation (section IIA), before we leave for the 1976 EAA convention at Oshkosh, Wisconsin. Because of our high work load now on these items, we must ask you to continue to observe our "Saturday only" policy as far as visiting RAF to see the VariEze, at least until after Oshkosh. We will be closed for the Oshkosh trip from July 23 until August 13. Any mail orders received at RAF after July 22 cannot be processed until after August 13 and, of course, there will be no Saturday demo on July 24, July 31, or August 7.

SATURDAY DEMOS - Since November, we have had the weekly open house at RAF every Saturday, starting at noon. These demos start with a briefing at our building (100 yards S.E. of the tower building on the Mojave airport), a question/answer period, then a flight demonstration of the VariEze, followed by a brief structural demo in which we build a portion of the airplane to show the composite sandwich methods. The demos run from two to four hours. In the 31 weeks we've been doing this, the VariEze has flown and given rides on all but two occasions: once due to rain and once when we had taken the airplane to an airshow. We have never canceled a flight demo due to an airplane problem or due to the severe wind gusts that occasionally ground most light aircraft at Mojave.

We will probably continue to give the Saturday demo after we return from Oshkosh, and will probably extend it to provide more time for the structural demo. Be sure to call ahead to confirm that the demo will be given, since we will be scheduling composite structure seminars in other cities and may be gone on some weekends. If you would like to host a seminar, please wait until after Oshkosh, then contact us. We'll include a seminar schedule in the October newsletter.

We do plan a daily construction demonstration in the synthetics workshop at Oshkosh for VariEze builders. VariEze forums at Oshkosh this year have been scheduled for Monday, August 2, and Thursday, August 5. A VariViggen forum will be Wednesday, August 4. .

VARIEZE FLIGHT TEST PROGRAM - N4EZ, our Continental-powered prototype, has undergone one of the smoothest prototype test programs we have

seen. In only two months and one week (March 15 was first flight, tests were completed by May 20), the aircraft completed an 85-hour test program which included development of the engine installation, all other systems, flying qualities optimization (all cg's, all weights), performance determination (with several propellers), dive tests, spin tests, and environmental qualifications (110 degrees ramp temperature, 16,000-ft altitude cold soak, taxi/take off/landing in wind gusts to 45 knots).

No major problems were encountered during the tests. Modifications made as a result of the tests included nose gear retraction/extension system redesign, addition of roll trim (VariEzes now have three-axis trim), addition of a parking brake, modification of air inlet configuration to optimize cooling, simplification of exhaust system, and optimization of pitch and roll control system ratios. It is interesting to note that throughout the complete test program of N4EZ and N7EZ, there has been no structural rework or modification required. This involves two airplanes, over 13 months testing, and 350 flight hours. This is quite unusual; generally a prototype of a new design (even a conventional structure) will indicate a few marginal or weak areas that need local beef up/redesign/adding fasteners, etc., sometime during its tests. With the VariEze, we have used new materials, initially unfamiliar to us, and new construction methods, etc., but have found them to be so durable in service, that no failures or degradation was found that required redesign. .

SPIN TESTS - FAR 23 certification criteria require aircraft to meet certain spin recovery requirements in order to receive a type certificate. This is not required for a homebuilt and many homebuilts have not been through any formal spin testing program at all..

CP09, Page 1

One primary reason the VariEze was designed as a canard configuration was to reduce the susceptibility to departure from controlled flight and unintentional spins. Conventional aircraft are so poor in this respect that stall/spin is the most common, fatal accident cause. A contributing reason is the FAR regulations, themselves. They are very specific in spin recovery requirements (after a one-turn spin, non-aerobatic aircraft must recover within one additional turn, with recovery controls applied), but only loosely subjective with respect to spin susceptibility. If specific resistance to departure and spin were required, as it now is for military aircraft (MILS-8369 1), few general aviation aircraft could qualify, making a lot less traffic for VariEzes!

The VariEze is designed such that the canard reaches its maximum lift at an angle of attack several degrees below that for maximum lift of the main wing. Above the maximum lift angle of attack for the canard (14 to 15 degrees), the loss of canard lift produces a strong nose-down moment. The result is that the aircraft limits itself to 15 degrees and cannot be forced above that angle, regardless of cg. The aircraft also is designed to have excellent directional stability, dihedral effect, and rudder control at and above 15 degrees angle of attack, thus the airplane is not susceptible to the inadvertent departure and spin common to most conventional aircraft.

The normal operational range of angle of attack is one degree (high speed cruise) to 10 degrees (flare to land at 55 knots). Angle of attack values above 10 degrees are not required for any normal operation, but were tested to assure the safety and recoverability, if the pilot inadvertently exceeds 10 degrees.

The pilot for our spin tests was Peter Lert, an experienced pilot, who makes his living as an aviation writer for "Air Progress" magazine, and who is light enough (135 lb) to allow aft-cg testing. The following is a summary of the results of the high angle of attack testing. The VariEze owners manual will have complete details.

The VariEze's "stall" consists of any one of the following, in order of prevalence:

1. Stabilized flight (climb, level, or descent, depending on power setting) at full aft stick at about 48 knots. Below 51 knots there is a very definite increase in the aft stick force, such that the pilot has to pull noticeably harder on the stick to get below 51 knots. Below 51 knots, the aileron control degrades, but rudders still provide excellent turn control, even at full aft stick.

2. Occasionally, particularly at forward cg, the airplane will oscillate mildly in pitch after full aft stick is reached. This is a mild "bucking" of a very low amplitude, one to two degrees and about one-half to one "bucks" per second. If the full aft stick is relieved slightly, the bucking stops.

3. Occasionally, particularly at aft cg, the airplane will exhibit an uncommanded Dutch roll, a rocking back and forth of the wings in roll. The rock, if it exists, will be mild and sometimes divergent, reaching a large roll (30 degrees bank) by about the fourth or fifth cycle. The "wing rock" can be stopped immediately by relaxing off the full aft stick stop, or by using the rudders to counter the rolling motion. At any time during the "stall," power can be set at any position, or slammed to full or idle, without effecting the stall characteristics. There is a small roll trim change due to power and a very slight pitch trim change; neither effect the aircraft's controllability at sustained full aft stick. At no time did the aircraft experience a departure from controlled flight.

Accelerated stalls to three-g and steep pullups to 60-degrees pitch (min speed, 35 knots) were done at full aft stick without any departure tendency.

Intentional spins were attempted by holding full aft stick and using full rudder, with all combinations of aileron control, and at all cg positions. These controls were held through 360 degrees of rotation. Full aft stick and full rudder results in a lazy spiral which ends up in a steep rolling dive at 3+ g and 110 knots. At any time, the spiral can be immediately stopped by removing rudder control and a completely straight-forward recovery can be made. That maneuver is not a spin, since at no time is the aircraft departed from controlled flight. If the above maneuver is done at aft cg, the rotation rate is higher, so the lazy spiral is more of a slow snap roll. However, even at aft cg the recovery is immediate when controls are neutralized.

OTHER FLIGHT TEST RESULTS - N4EZ has demonstrated take off and landings in crosswind components as high as 20 knots and satisfactory taxi (all quadrants), take off, and landing in gusty winds to 45 knots. N4EZ has also flown through very heavy turbulence in a rotor cloud under a triple lenticular in which g excursions went from -1 to +3.5 g. The red line speed has been opened to 262 true/220 mph indicated, a comfortable margin (exceeds FAR part 23 requirements) even for the largest engine (100 hp) which can cruise as high as 200 true/176 indicated (at 7500 ft). Damping of all controls at the dive speed is excellent and similar to low speed. If, at a later date, we have a requirement to extend the red line to higher speeds, we will do so.

ENGINES - Cooling on the 0-200 has been excellent. Ground cooling is better than most factory-builts. At a recent flying, we had to sit in a long line on a hot ramp awaiting take off for over 30 minutes. Many of the factory-builts had to shut down to avoid over heating, but N4EZ's temperatures stayed under the normal values for cruise. The 0-200 Continental engine has been trouble-free, requiring no modifications, adjustments, or unusual maintenance. This has not been true of our VW installation on N7EZ. We have flown the VW VariEze a total of about 280 hours (two different engines), which is a lot of flying for one year for a VW homebuilt. We have had its cowling off an average of once per five flights, though, making minor carburetor adjustments, trying to find oil leaks, adjusting or repairing valves, cleaning plugs, checking the magneto coupling, tightening loose bolts, etc., etc. The VW-powered VariEze has never had an inflight power failure, but it has twice had to be landed within a few minutes or it would have had a failure: once due to low oil pressure, another time due to an impending failure of the prop hub/extension. We have conducted an informal survey and found that our VW experience is quite similar to others, who have high time on VW aircraft conversions. For this reason, and because of the high cost of operating these engines, we are not preparing the section IIB, VW engine installation, at the present time. This section should be made available by October as we gain some more reliability experience with the engines and after the results of some further tests.

Those of you who plan to use a VW do not have to delay your project. The engine installation is done during chapter 23 (of 25 chapters) of section I. All items involving changes due to engine installation are in section IIA or IIB. If you can't find an engine or haven't decided which type you plan to use, we suggest you get only section I and go ahead and start building. Chances are, you will find the right engine at the right price before you get to chapter 23.

Frankly, when we went shopping for an 0-200, we couldn't find one. We let several people know we were looking, then all of a sudden several weeks later, we had our choice of four 0-200's! When searching through "Trade-A-Plane" for engines, don't look only at the engine section. Quite often you can buy a wind damaged Champ or Cessna-150 with a lot of time left on the engine for less than a used engine! We get a lot of questions concerning the availability and cost of engines. We, of course, are not in the business of engine distribution, however, to

give you an idea of the current market, we have made up the following table, based on available prices from vendors, "Trade-A-Plane," and magazine ads. Cost per hour is basic engine cost, not including fuel and oil.

ENGINE	1 TIME AVAILABLE TILL NEXT OVERHAUL (REGULAR USE - 300 HR/YR)	2 OUTRIGHT COST FOR ENGINE	3 VALUE OF ENGINE AFTER RUNOUT	4 COST TO OWNER (2 - 3)	5 ENGINE COST PER HOUR OF FLYING
A65/A75 OSMOH	1200 hr	$1300	$ 400	$ 900	$0.75
A65/A75 half-runout	600 hr	$ 800	$ 400	$ 400	$0.66
C85/C90 OSMOH	1200 hr	$1900	$ 700	$1200	$1.00
C85/C90 half-runout	600 hr	$1300	$ 700	$ 600	$1.00
New 0-200	1800 hr	$4700	$1600	$3100	$1.72
0-200 OSMOH	1600 hr	$3000	$1200	$1800	$1.13
0-200 half-runout	800 hr	$2300	$1200	$1100	$1.38
Top of line VW conversion	800 hr?	$2600	$ 800	$1800	$2.25
"Low cost" VW conversion	100 to 600 hr?	$1300	$ 200	$1100	$2.20

PROPS - We have tested several propeller types and studied several others. Fortunately, the best prop has been the lightest and lowest cost - a fixed-pitch, all wood, two-blade, with plastic leading edge for rain erosion protection. These are available through several vendors. The owners manual (section IV) and section II will specify prop sizes, specifications and recommended vendors for all recommended engines.

The three-bladed prop tested, resulted in less take off, climb, and cruise performance, as compared to the two-bladed props. We do not plan to request our distributors to stock propellers. The reason for this is due to the large number of engine sizes available, and different prop extension configurations; it is better for the customer to deal directly with the prop manufacturer.

Those of you who are in a rush to be flying a VariEze as soon as possible, may not want to wait for section II to put in an order for a prop, since props are one of the hardest things to get without waiting several months. Thus, we are providing sizes and manufacturers for the 0-200 props we've tested. These are listed below. Other prop manufacturers may also be able to provide adequate props. Refer to the owners manual for prop sizes on other than the 0-200 engine.

Teds Custom Props	Bill Cassidy
9917 Airport Way	4652 Montview Blvd.
Snohomish, Wa. 98290	Denver, Co. 80207
56" dia 70" pitch	58" dia 67" pitch
VariEze SAE#1 flange	VariEze SAE#1 flange

Maximum speeds for the above props is identical. The Ted's prop provides a small edge in take off and climb. This is backwards from what you would think considering the diameter and pitch values, the blade design being considerably different on the two props.

NOSE GEAR RETRACTION - We told you in newsletter 8, that we were making a major change to the system that retracts and extends the nose gear, to incorporate a jacking mechanism to give the pilot a better capability of raising and lowering the nose for nose-down, parking with the pilot aboard. This system was built and installed in N7EZ, however, like the four other mechanisms used before, it was not satisfactory. It did allow the pilot to jack the aircraft up to level after entry, but the work required for him to do this (600 ft-lb) was still objectionable. The spring systems (needed to pull the strut up in flight) and the reversing system made the complete package too complicated and time consuming to build and maintain. We found that we had more complexity in the nose gear retraction system than in the entire pitch, roll, and yaw control systems combined! This was completely against the design concept of the airplane.

After, again, backing off and taking a look at the problem, we found that it is considerably easier to lift the airplane's nose up from the nose-down parked position, lock the gear down, then enter the airplane by climbing over the side, like we do on the VariViggen, using a kick-in step in the fuselage side. This allows a very simple, lightweight pushrod system to work the gear up and down, and allows an instant-acting inflight retraction/extension. The design and installation of this new system in N7EZ took only one day. It consists of a single pushrod to the gear strut from a knob at the instrument panel. The pushrod is bolted to a block which slides in guides such that it locks up or down by locking the knob in its lowered position.

We have been very pleased with the new system; it has required no maintenance and appears to be one that will not give problems, due to its simplicity. Retraction of the gear in flight consists of moving the knob out of its lock, raising it and pulling aft 6", then locking it in its lowered position (one smooth motion). Retraction/extension forces are only about 5 lb since airloads balance the gravity loads. Ground operation of the gear for nose down parking works as follows: back seater and suitcases go in while the nose is down. Manual engine starting is done while nose down on the rubber bumper (no chocks or tiedowns are required for manual start by yourself). The pilot then walks to the side of the cockpit, unlocks the gear knob, and raises the airplane to a level attitude. This is easily done by grabbing the leading edge of the canard and lifting (requires only about 30 lb, even with the backseater in). The pilot then locks the knob and uses the kick-in step to climb in. We have modified the yaw trim system to also provide a parking brake to keep the airplane from rolling (while the pilot climbs in) if the airplane is parked on a downhill slope. The new nose gear system now compliments, rather than distracts from, the overall design philosophy of simplicity and low maintenance.

VARIEZE STRUCTURE - To certify an aircraft for production, FAA requires the manufacturer to load the flying surfaces to 150% of design limit

load. After that loading, it is acceptable for the surface to be damaged beyond repair, but it must be in a condition to allow a safe landing. To demonstrate the structural adequacy of the VariEze's wing and attachment, we had someone, who had no previous fiberglass construction experience, build a wing from our plans. We mounted that wing in a test fixture and loaded it over 200% of design limit load. The wing had absolutely no damage, not even the transverse matrix cracking that occurs with composites at about 2/3 ultimate load! Just for kicks, we rounded up eight people and had them all stand on the wing - that was as many as could crowd onto the wing, but resulted in much less load than the formal test done with lead shot bags.

Structurally, the Eze has some very important advantages over conventional metal or wood: greater redundancy, less susceptible to catastrophic failure due to fatigue, less susceptible to corrosion or deterioration, higher safety factors, easier to inspect and repair and less susceptible to surface damage. With proper ultra violet protection (as shown in VariEze section V), the composite structure should outlast metal or wood in any type environment.

Do not compare the VariEze's glass/foam/glass sandwich structure to the method used on the KR-series, WAR-series, etc. The VariEze structure does not use foam to transmit primary/secondary loads, does not mix materials in a manner to result in thermal stresses, does not mix structural materials with highly different modulus of elasticity, does not seal off internal void areas where moisture can collect, does not have any bare foam surfaces that can flex and fatigue the foam, does not use a low modulus skin that results in high foam stresses, does not use inadequate skin close-outs at trailing edges and joints, etc. If you are not familiar with the structural techniques used in advanced composite sandwich design, you are in for some real surprises when you see the VariEze manufacturing manual. Don't expect the structure to even remotely resemble anything you have seen in any homebuilt aircraft!

You are going to be building sandwich panels, joints, local reinforcements, attachments, spars, compound curves, etc., very similar to those used by large manufacturers for new military fighters and portions of new airliners. The methods to fabricate the parts are quite different though, since you will be doing the work without special equipment and tooling.

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VARIEZE PLANS - You will find a sheet enclosed with this newsletter that describes the five-section package of VariEze documentation that is now being made available. Section I, the manufacturing manual (composite education, complete plans and construction manual for the VariEze, except for engine installation), is the major bulk of the documentation. This section was delivered to our printer on June 15 and should be back, ready to mail out by about July 1. We have completed the draft of section IV, the owners manual, and will have it printed and ready to mail by about July 10. We are also making a strong attempt to complete section IIA (Continental engines installation) during July. Hopefully, it will be completed before we leave to attend the EAA convention at Oshkosh. If it's not done by

then, it will not be ready to deliver until late August. Section III (avionics and lighting) and section V (finishing) will not be completed until September. Section IIB (Volkswagen engines installation) should be completed by October.

PRICING PHILOSOPHY - VARIEZE PLANS - We think that its of some interest to discuss the items considered in determining the price to charge the homebuilder for his set of plans. Plans prices for other homebuilts vary from just a few dollars over printing/handling costs, to several hundred dollars. Designers who sell plans for a small amount over direct costs, in order to sell thousands of sets of plans, generally find that they have sold the customer only the stack of paper, but not the service of assisting him to assure his success in completing his project. Often, designers will put an extremely high price on a set of plans and will thus receive about the same income, but have a lot fewer customers to assist. Sometimes a designer will do this to quickly recover development costs, without planning a long-term support program.

The VariEze plans have been priced to compliment our entire program of supporting each homebuilder's project to assure his success, and to provide a return on our investment in development costs within the next two years. About $50 of each set of plans sold, goes directly towards paying back the $100,000+ required to develop the design. We are both quite fortunate that that the airplane was developed, to a complete homebuilt program, for this relatively small sum of money. If any major problems would have been encountered, such as engine/prop compatibility/reliability, or spin characteristics, or structural failures, etc., the development costs could have been considerably higher. It is not uncommon for a new design to require three or four times or even 30 times that amount by the time it successfully completes the testing we have finished on the VariEze. It is not unusual for a new design, particularly one with marginal structure or systems, to end up costing so much for development that it is never satisfactorily completed. This is why it is impossible to market an aircraft before its development is completed.

You may note that the VariEze plans are higher cost than some of the other small, simple-airplane plans. However, considering the fact that they include a complete education of the materials and structural methods, and are a fully illustrated step-by-step manufacturing manual, they are actually quite inexpensive; for example, when compared on a page-for-page, word-for-word, photo-for-photo, or drawing-for-drawing basis, the VariEze plans cost less than one-third the price of the KR2 plans.

VARIEZE MATERIALS/COMPONENTS DISTRIBUTION - Okay, this is it; the big secret is out! The distributors we have been working with for the last nine months on the VariEze program are listed on the last page of this newsletter. Included in the list are the general items of the bill of materials that they stock. Unless you are in a big rush, wait to get your plans before contacting the distributor. Your plans has the complete bill of materials with each item specified as to its use and availability. Both the major raw materials distributors (Aircraft Spruce and Wicks) are presently preparing new catalogs, which list the specific VariEze materials. These catalogs will be available from them in early July.

We have been indicating to you in recent months that the distribution system will be able to supply all materials and components on very short notice, because of their stocking items ahead of time. They have done an excellent job in this respect, but the apparent initial demand for the VariEze may have exceeded our expectations. Certain items and materials may initially be in short supply and some delays are now anticipated. If you are planning to build your aircraft in a rush over the next few months, we suggest that you get your orders in immediately for the following items. These are the greatest potential 'bottle-neck' items that we can foresee at this time. Foams (manufacturer's recent specification revisions have delayed early high volume stocking), wing attach/quick-disconnect fittings (Brock), and landing gear struts (Jiran).

FOREIGN customers who are interested in making volume purchases to minimize import duties and shipping costs should contact the distributors directly for volume purchasing information. The distributors are equipped to handle this type of order.

VARIEZE QUESTIONS/ANSWERS - Thanks so much for those of you that have had the patience to wait for the newsletter to get your questions answered. If you have a question you need answered right away, state it, with room for our answer, and include a self-addressed, stamped envelope.

Q. My wife is 6 ft, 5" tall - can she fit in the back seat?
A. The front seat allows "stretch out" comfort (feet in front of the rudder pedals if you desire) for pilots to 6'7" and 210 lb. Back seat is comfortable for pilots' passengers up to 6'5" and 220 lb. In fact, those of you who were at the Watsonville flyin, may have seen a 6'9", 210 lb man get in the back seat, with the two full suitcases. His comment - "relatively comfortable." Even he was not pressed up against the canopy.

Q. Can one person remove/install the wings and canard?
A. Yes, the specific procedure is in the owners manual. It takes one tool and about two minutes per wing/canard. Instead of trailering, we suggest you remove one wing and store your aircraft under the wing of a Cessna in a T-hangar or in an unused corner of a larger hangar. In this way the availability and high cost of hangars can be avoided and the big job of tieing down on a trailer is avoided.

Q. What percent of construction work requires more than one person at a time?
A. Required, about 15%; desired, about 50%

Q. Can a 197-lb, 160-horse power engine be used in a VariEze?
A. No.

Q. Will you offer dual controls?
A. We plan to develop dual controls later, possibly this winter. It's not as easy as one might think. It will greatly complicate the control system and may eliminate one suitcase. The Eze is easy to fly and pilots can be checked out safely if they follow the owners manual procedure. Its hands-off flying qualities lowers the need for backseat controls for pilot fatigue relief.

Q. Is an intercom necessary?
A. No, pilot and passenger can easily converse in a normal level of conversation at cruise power settings.

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Q. How does a composite aircraft behave in a fire?
A. First of all, the VariEze's susceptibility to an airframe fire is far less than the average light plane. The flow of air through the engine area is aft and up, so an engine-area fire is drawn away from the airframe, rather than being impinged upon the firewall as in conventional installations. Also, the fire which results from a crash is generally due to oil or fuel being ignited by sparks from steel on rock, etc. The Eze's fuel tank durability and fuel line routing is a plus factor. The lack of steel items that can cause a fire's ignition source, is also an advantage. Now, if a fire does exist, the rate at which burning progresses in the glass/foam/glass sandwich structure, ranks between an all-metal airplane and a wood or fabric airplane.

Q. Minimum size door in the shop to hatch a finished VariEze?
A. If you leave the main gear off until after the airplane gets out of your shop, a 30-inchx68-inch door or window is enough.

Q. How do you air-start a VariEze without electric start?
A. Due to the high pitch of the prop, the engine windmills at all speeds down to about 60 knots.

Q. Cabin heat?
A. Drawings for cabin heat are included in section II, however, due to canopy radiant heating and the excellent insulation of the sandwich structure, cabin heat is not needed for day-VFR, even at cold outside temperatures.

Q. CAN I get color photos of the VariEze?
A. RAF has none for sale, however, Jim Jeffries Productions, Inc., has been up taking photos of N4EZ and has expressed an interest in making a color photo set available for sale. Contact him at Box 14, Santa Paula, Ca. 93060, for details.

Q. I have a 900-ft grass strip out back. Should I build a VariEze to operate out of it - it's a little rutted in the winter.
A. No. Buy a Cub or build a Volksplane. Lift off speed and landing speed of a VariEze is 55 to 60 knots (63 to 69 mph), which takes it out of the "backyard patch" category. We have increased the tire size from the prototype Eze to help its rough field capability, but the 55-knot touch down is definitely not recommended for your pasture. The best rule is this: "If you would operate an American Aviation Yankee from your field, it's okay for a VariEze."

SOME PERSPECTIVES ON ENGINE DEVELOPMENT - We are probably going to hear a lot of anguished cries from would-be engine developers, but we are taking a hard line on "other" engines in the VariEze. We have had many calls and letters from people wanting to install all kinds of converted boat, snowmobile, auto, turbocharged trash compactor, etc., engines in

a VariEze. Also, there is an interest in all kinds of unproven modifications to the VW (fuel injection, turbocharged, electronic ignition, etc.). Frankly, we're scared stiff by this. Aircraft engine development is a very risky, horribly frustrating, and enormously expensive business. Please don't kid yourself into thinking that you can do a successful engine development program in order to save money! Please don't kid yourself and think your new engine conversion isn't going to fail a few times during initial flight testing. Even a professionally trained, educated, and experienced engineering organization with a barrel of money, can't do these things, so don't try it in your garage. More over, don't believe anybody who says he can do it for you, unless he can show you excellent maintenance records taken during hundreds of hours of flying with the engine.

We are very much afraid that if a lot of homebuilders start trying to develop new engines on homebuilt airplanes, that EAA's accident record will look horrible. When that happens, look out for the FAA to really clamp down on homebuilding. We have gotten warning indications that this situation is already bad and getting worse. Doing engine development on an amateurbuilt airplane hurts everyone of us by further endangering the lenient rules that we now have. Please don't do it.

This isn't to say that some very good engines aren't hiding out there, waiting to be developed for aircraft use. We wish the best of luck to those who have the funding, ability, and ambition to do the job well. Doing an engine development job well, implies that you have the professional ethics not to endanger the hard won privileges of others.

Now, if you have an engine, it looks good to you, and you really want to prove it out for aircraft use, here's what you do: fly it. There is no substitute for flight experience. Not in a homebuilt, though!! Get yourself a Cub or Champ that is a very forgiving airplane, easy to land safely in a pasture. You are going to make several emergency landings, so plan on it. If things really get bad and you have to plant your test vehicle in the trees, then for FAA it's just another Cub that crashes, not a homebuilt. Also, you can buy another Cub and get your test program rolling again, quickly. If you had used a homebuilt, you would have to build another airplane instead of getting on with your engine development work. Once you get your new engine working like you think it should, fly the pants off it, maintain detailed maintenance records, and find out just how well it really holds up over a full overhaul period. Find out how much it really costs you to fly each hour, considering initial cost, operating costs, maintenance, replacement, and everything else. We once participated in a "low cost" engine program where the initial engine cost was less than 10% of the 100-hp Continental, but taken hour-for-hour of service, the cheap engine costs more than eight times as much! Remember, an aircraft engine is the very definition of dependability and reliability. An aircraft engine must tolerate abuse and still keep pumping along.

Right now there is a promising looking engine powering a Cub that is being considered for section IIC of the VariEze manufacturing manual. The gentleman behind this effort was originally going to do his development testing in a homebuilt Cassutt racer. Fortunately we were able to talk him into using the Cub. During the initial flights, at least four precautionary landings had to be made (this is perfectly

normal in initial flight testing new engines). In the Cub, it was no sweat; in the Cassutt (high wing loading, fast on landing, high rate of descent), it might have meant a broken airplane, possible injury to the pilot, and another statistic to hurt our EAA safety record. These fellows are to be congratulated on a very sensible, professional, and ethical test approach. Now we just hope that they are successful, so we can have an alternative to the Continental, but even if they aren't, they will have helped to preserve the good name of EAA and the freedoms we now have.

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VARIVIGGEN ACTIVITY - The VariViggen portion of this newsletter is quite short. We haven't heard much from you VariViggen builders lately, and no one has noted any plans corrections since newsletter 8. I guess you are all busy building! I understand that at least three VariViggens are nearly completed and we hope to have some firstflight reports in newsletter no. 10. Let's hear from you!! Ken Guscott (S/N 129) has a VariViggen construction article in the June 76, "Sport Aviation" magazine.

N27VV has undergone no modifications or maintenance since the last newsletter. It has only flown about 25 hours in the last three months, mostly for chase during the VariEze spin tests and for cross-country trips. Those of you who may be close to finishing your airplanes, be sure you have the VariViggen owners manual. It has very important operational data, amendments to the operating limitations and a specific recommended procedure for the conduct of your initial flights.

VARIVIGGEN PROJECT REPORTS -
Doug Dennis, SN 421, reports that he has one rudder, his canard and both elevators ready for skinning. Doug is assembling his fuselage jig and frames now. Sounds like a good start; hang in there! Doug is 15 years old, by the way!

John Poehner, SN 156, fuselage and inboard wing about ready for skinning.

Harold Reiss, SN 267, has his fuselage skinned on the sides and the aircraft is ready to turn over for bottom skinning. The instrument panel, wiring, nose and main gear, controls, seats, carpeting, etc., are installed. He started his Viggen 13 months ago.

Jim Cavis, SN 31, has his aircraft completed and painted except for outboard wing panels and canopy.

VARIVIGGEN BUILDERS' HINTS -
Harold Reiss, SN 267, is using an "A" frame made of 2x4 lumber which bolts through the four engine mount bolt holes in the firewall. He uses this to support the fuselage while it's inverted to skin the bottom, rather than using saw horses under the spar. Harold also reports that he used five, 16" door springs for each of the main gear helper springs, stretched to about 24".

Wayne Wilkins, SN 208, has an interesting method for making WR25 in three pieces so that spar E can be assembled completely off of the airplane (see photo).

More on the prop situation for the 180-hp Lycoming (see newsletter 8) - There is an excellent article on this subject in the June issue of "Sport Aviation." Note that while insufficient driving area is available in the studs, the friction face provides ample safety factors even for the 180-hp engine. Those using the 180-hp engine and a wood prop should carefully follow the recommended procedure for torquing and checking the tightness of the prop bolts at the intervals indicated in newsletter 8.

Clarification - The MG37 tube on MG14 is open at the top, not welded over (plans page 47 & 48).

Bob Tate, 4800 Mayfair Drive Oklahoma City, Oklahoma (405) 946-7839 Wants to purchase a partially-built VariViggen. Contact him.

VARIVIGGEN SP WING BUILDERS - To avoid the exotherm noted in newsletter 8, and to obtain the benefits of increased fatigue strength and low toxicity, it is recommended that you use the long pot-life epoxy developed for the VariEze. This is RAES epoxy (four or five one-gallon kits are required). This epoxy is available from Aircraft Spruce or Wicks; see last page of this newsletter.

VARIVIGGEN PLANS CHANGES
Mandatory Change Plans page 43 - The fuel system drawing (pg 43) shows the fuel valve located slightly above the level of the bottom of the tank. Revise this drawing as shown in the accompanying sketch. The fuel lines should run continually downhill to the strainer, then continually uphill to the carburetor. If there are loops that can trap air, the amount of unusable fuel will be increased, particularly during a steep nose-down descent. Add the following note to page 12 of your VariViggen owners manual: "NOTE: If a sustained steep descent is made when the fuel level is less than six gallons, a temporary fuel starvation may occur. This is characterized by a surging of the engine. If this occurs, level out and slow up (nose up, 70 mph if necessary). Normal fuel flow will resume and the engine will begin operating normally." **SKETCHES OMITTED**

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Wayne Wilkins S/N 208. Note the 2" x 3" doubler used to join front & rear halves of W.R. 25 rib.

John Poehner at "work" on the instrument panel.

John added a detent-type handle to the manual pitch trim system.

John Poehner's VariViggen just ready to come out of the jig.

"Informal" static test of the VariEze's wing - anyone care to join us?

BELOW IS VARIEZE SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIEZE TWO-PLACE SPORTPLANE

**PHOTOS OMITTED

THE STORY
For the last 12 months, we have refrained from promotional activities and marketing on the VariEze to concentrate totally on its development and setting up materials and components distribution. In this short time, we have 1. flown a full 350 flight-hour test program on two prototypes, one Continental and one VW-powered, 2. completed full structural qualification testing, 3. prepared a manual for the amateur builder to educate him in the structural materials and to guide him through construction, 4. set up a materials distribution system through established, competent distributors.

THE TEST PROGRAM
The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE RESULTS
The VariEze has superb flying qualities for its primary mission - comfortable travel. It has excellent hands-off stability even in turbulence. It is unusually safe at low speeds, can be flown with full aft stick (47 kt) without being susceptible to departure or spin, regardless of attitude or power. Performance is also superb - cruise up to 200 mph and climb up to 1700 fpm at gross weight with the larger engines.

THE MISSION: PRACTICAL UTILITY
Although quite compact outside, the VariEze provides unusual comfort for up to 6-ft, 7-in, 210-lb pilots and 6-ft, 5-in, 220-lb passengers, plus two medium-size suitcases and four small baggage areas. The 24-gallon fuel load allows up to 1000-mile range at economy cruise. High altitude climb is excellent, for flying over turbulence, mountain ranges, and for satisfactory high-density altitude take offs.

THE DESIGN
The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic systems design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE STRUCTURE
New composite sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, longer life, improved contour

stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair.

THE HOMEBUILDER SUPPORT
The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations. Construction seminars are provided at RAF and elsewhere.

THE AVAILABLE HOMEBUILT
Established, competent distributors have stocked materials and components before the aircraft was marketed. All raw materials are now available plus many prefabricated items including canopy, landing gear, wing quick-disconnect fittings, cowling, all machined items, rudder pedals, engine mounts, suitcases and upholstery. If you choose to purchase all prefab parts, you can build your VariEze in about 500 man-hours - really!

VariEze documentation is available in five sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full-size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words! The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, A75, C85, C90, 0-200
SECTION IIB - VW engines (avail. Oct '76)

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system, avionics, landing and position lights, antennas, starter. Avail Sept. 76

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim. Avail Sept 76

Specs & performance with 100-hp Continental.fixed-pitch prop.@ gross weight

Take Off	800 ft
Climb	1700 fpm
Max Cruise	200 mph
Econ Cruise	165 mph
Range @ Max Cruise	720 mi
Range @ Econ Cruise	980 mi
Min Speed (full aft stick)	49 kt
Landing	900 ft
Canard Span/Area	12.5'/13 square feet
Wing Span/Area	22.2'/53.6 square feet
Empty Weight	520 lb
Gross Weight	1050 lb

Specs & performance with 75-hp Continental

Take Off	950 ft
Climb	950 fpm
Max Cruise	178 mph
Econ Cruise	145 mph
Empty Weight	490 lb
Gross Weight	950 lb

Check items desired:	Price, including First class mail U S and Canada	Air mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher' newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$94.00	$108.00
Section IIA or	$19.00	$21.00
Section IIB		
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00

Calif. residence add 6% tax on all items except newsletter

* U.S. funds only

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft stick	49 mph
	Landing	500 ft

Performance with 150-hp.	Climb	1000 fpm
Special Performance Wings	Cruise	158 mph
Specifications	Canard Span/Area	8 ft/18.3 square feet
Standard VariViggen	Wing Span/Area	19 ft/119 square feet
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications	Wing Span/Area	23.7 ft/125 square feet
Special Performance Wing	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas,

improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price: $4.75 per year first class mail, $6.50 air mail overseas. Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing, 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described. Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles. Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price: $4.75 first class mail, $5.50 air mail overseas.

The following are RAF-authorized distributors of materials and components. Items indicated have been developed under RAF approval and are recommended for VariViggen or VariEze aircraft. Contact the distributors at the address shown for his catalog and description of items. Indicate to him that you are a VariViggen or VariEze builder.

AIRCRAFT SPRUCE & SPECIALTY CO.
201 W. Truslow Ave.
Box 424
Fullerton, Ca. 92632
(714) 870-7551

OR

WICKS AIRCRAFT SUPPLY
1100 5th Street
Highland, Il. 62249
(618) 654-2191

Catalog cost $2 - Refundable at first order.
VariEze materials: epoxies, foams, fiberglass, filler materials, wood, metals, all hardware, specialized tools, skin barrier cream, seat

belt/shoulder harness sets, wheels & brakes & custom upholstery/suitcases.
VariViggen materials: spruce kit, plywood kit, hardware, aluminum & fiberglass.

KEN BROCK MANUFACTURING Catalog cost $1 - Refundable at
11852 Western Ave. first purchase.
Stanton, Ca. 96080
(714) 898-4366
VariEze prefabricated components: wing attach/quick disconnect assemblies, nose gear machined parts, control system components, fuel cap assemblies, welded engine mounts, welded stick assembly, welded rudder pedals, wheels & brakes.
VariViggen prefabricated components: all machined parts.

FRED JIRAN GLIDER REPAIR Write for brochure.
Building 6, Mojave Airport
Mojave, Ca. 93501
(805) 824-4558
VariEze prefabricated components: Molded S-glass main gear and nose gear struts, nose gear strut cover, nose gear box.

COWLEY ENTERPRISES Write for brochure.
P.O. Box 14
Santa Paula, Ca. 93060
(805) 525-5829
VariEze plexiglass canopy - Light bronze tint or clear.

H. C. COMMUNICATIONS Write for brochure.
Box 2047
Canoga Park, Ca. 91306
VariEze and VariViggen custom COM & NAV VHF antennas.

MONNETT EXPERIMENTAL AIRCRAFT, INC. Ask about VariViggen parts.
955 Grace St.
Elgin, Il. 60120
(312) 741-2223
VariEze - None
VariViggen - All molded fiberglass parts

GOUGEON BROTHERS Write for brochure.
706 Martin St.
Bay City, Mi. 48706
VariEze - None
VariViggen - 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS Contact him for list
4102 Twining
Riverside, Ca. 92509
VariEze - None
VariViggen - welded nose and main landing gear, 1-1/4" sq. steel tube.

BILL CAMPBELL (VariViggen builder) Contact him for list.
Box 253
Phelan, Ca. 92371
VariEze - None

VariViggen - Prefab brackets and fittings.

JESSE WRIGHT Contact him for list.
7221 S. Colorado Ct.
Littleton, Co. 80122
VariEze - none
VariViggen - prefab wood parts.

THE CANARD PUSHER NO. 10 OCT 76

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RAF ACTIVITY since the last newsletter has included a wide range of projects. The VariEze plans (Section I) were put on the market in early July. Demand for the plans far exceeded our expectations and at times our ability to keep up with orders. Apologies to those who had to wait several weeks for plans. Both the VariViggen and VariEze homebuilt prototypes flew to Oshkosh this year for the EAA convention. Both the VariEze and VariViggen performed in many of the evening airshows during the convention. Oshkosh was a busy nine-day event for us. Each day we had a 'builders only' discussion session at both the VariViggen and the VariEze. In addition we conducted a daily two-hour construction seminar in the work shop and three forums. We are hoping to have home-built VariViggens and EZE'S at Oshkosh '77 to take a little of the heat off of the prototypes!

Our summer has been a fast one. The Section I orders, builder support trips, etc. has really kept us at a gallop. Those of you who have ordered Sections IIA, III, and V know that they are not available yet, partly due to the summer's hectic pace and partly due to distractions. We had to do some additional flight test work on the fuel system in preparation for Section IIA. We also completed the detail design of a research airplane for N.A.S.A. utilizing VariEze technology. The N.A.S.A. airplane is a small, one-pilot test vehicle that is intended to test the handling characteristics of a future (1990's) yawed-wing airliner. We are currently proof reading Section IIA and it will go to press shortly. With allowance for printing holdups Section IIA should be available by the first of November; Sections III and V should follow in mid-November.

The VariEze distributors appear to be gaining on their back-log of orders now that the materials pipeline is filling. Aircraft Spruce and Wicks have indicated that the basic materials are now being shipped with-in four to eight weeks of order. Check with them directly for a current lead time. Ken Brock advises us that he is shipping wing fittings and has most of the nose gear parts available now. Those items which Ken doesn't have available yet are not shown on his brochures; he will notify you when they are ready.

We have firmed up our construction seminar schedule for the fall. These seminars are really just for builders and those who have at least studied the education chapter. Don't encourage a group that is just idly curious to attend; this just crowds the seminars and makes it hard for active builders to get their questions answered. If you plan to

attend a seminar and have questionable or defective parts, be sure to bring them along. Swallow your pride and let other builders profit from your mistakes.

October 9 and 10	Highland, Illinois
Contact:	Wicks Organ Company 1100 - 5th Street Highland, Illinois 62249
October 23	Mojave California at RAF
October 30 and 31	Boston, Massachusetts
Contact:	Dale Findlay Aero Sport Inc. Minuteman Field Box Borough Road Stow, Massachusetts 01775 (617) 897-6021
November 6 - 14	England and France
Contact:	Harold Best - Devereux. 13 Stonehills House Welwyn Garden City Herts, England
November 21	Austin, Texas
Contact:	Bob Wahrmund EAA Chapter 187 Route 1 Box 119B Round Rock, Texas 78664
November 28	Mojave, California at RAF noon - 6:00
December 5	Sacramento, California
Contact:	Ed Hamlin 8377 Seeno Avenue Roseville, California 95678
December 18	Atlanta, Georgia
Contact:	John Griffin, Sr. 420 Northland Road Mableton, Georgia 30059
December 19	Daytona Beach, Florida
Contact:	William Cook 130 North Highland Avenue Daytona Beach, Florida 32014

If you want to attend any of these seminars send the contact a postcard and tell him how many in your party. If you want a reply, send a S.A.S.E.

We have heard from a couple of clubs that have been formed by VariEze builders for mutual support. One group in Minnesota is so big that they have become a special interest EAA chapter! The club idea is a good one, in that builders can better aid each other in construction problems.

We have received N.A.S.A.D. approval, class one (average amateur), for the VariEze plans.

If you want to stop by RAF and visit, give us a call first and make sure we are home. We are not able to show the prototypes on an

individual basis yet. If you want to see the airplane please plan to attend one of the seminars in Mojave or hold off until after January. We will be in a different building after January and will have a showroom/hangar where you can see the airplanes. We are a mile from our aircraft now which makes showing them individually an awkward thing to do.

MATERIALS DISTRIBUTION

In the initial rush for materials that followed our release of Section I last June, the distributors were completely swamped. Frankly there were a whole bunch more ready-to-start builders than we ever dreamed of and the result was almost immediate exhaustion of available materials. In the wake of the delays which followed we have received a few complaints from builders who have had to wait six to ten weeks for materials from our distributors and we feel that we owe everybody a brief explanation of how the present distribution system came to be.

RAF is a very small company with no desire to expand into distribution or manufacture of materials or components. When we originally started planning to market plans for the VariEze we were not going to be referring customers to any specific source for materials, since all materials were to be available in just about any reasonable-size city. We were going to build the airplane with a common industrial weave of glass cloth, with a popular Shell laminating epoxy system and with any type urethane foams, available at any well stocked building-supply outlet. We would thus be able to give the specifications in the plans and let the homebuilder find his own source of materials. When we started building N7EZ (then called the mini-Viggen) we ran into some problems. The glass layups were quite difficult in many areas and looked beyond the capability of many all-thumbs builders who would want to build one, and there was a large weight variance due to workmanship. Thanks to Fred Jiran, the glass sailplane wizard, we found a solution: specially designed weaves of glass cloth that took most of the work out of the layups, resulted in far less weight variation, and fewer man-hours than the materials we had been using. We then realized that not only would the materials be easy to work with, but also construction would be much quicker than working with conventional wood or metal. It was then that the name 'VariEze' was adopted. This, of course, threw a wrench into our plans to not market materials, since the cloth was available only in Europe and required a large special order to get it made here. We then decided to invest in a special order, sell the cloth to the homebuilder, and let him scrounge the remaining material wherever he could.

Next, we ran into several problems with the epoxy. Its toxicity was quite high (SPI-4), mix ratio at 12 percent was very critical and we were certain we would need two pot lives due to the exotherm damage we found on our high temperature insulated tests. Thus, due to the high ventilation and skin protection requirements and uncertainty of local availability of the required hardener systems, the viability of the project was in doubt. About that time we met with several composite engineers working in the advanced composite development department of a large aerospace corporation. We had a meeting at their facility and described the entire VariEze structure to them and discussed with them the epoxy problems we were experiencing. They were anxious to not only solve our problems but also to suggest that recent developments of

elastomeric - modified epoxy systems would greatly add to the fatigue life and peel strengths in our structure. We initially tried a commercially available system but found the work-ability poor due to higher viscosity and the pot life still not optimum. What followed was a long series of testing numerous variations, attempting to optimize the formulation of the epoxy system. Building components for N4EZ (the homebuilt prototype), samples for strength, environmental and exotherm tests, gave us a good basis to evaluate the system for not only physical properties but also for work-ability. The result was a system that was not only less toxic (SPI - 2) but also had considerably better fatigue and peel strengths (data are shown in an article in the July issue of "Sport Aviation").

Since marketing glass and epoxy was beyond the scope of materials distribution we were interested in, we decided to have a couple of established distributors stock the epoxy. Then came the bad news. Yes, formulators would be happy to formulate the epoxy system but the retail price would be almost $35.00-per-gallon kit, almost twice the retail price of the original Shell system and adding $200.00 to the price of the airplane. We then decided to have the distributors stock both the Shell and the new system (now designated RAE) and give the homebuilder his choice, noting that certain aspects of the construction methods and the physical properties would suffer with the lower cost material. One of the composite design engineers who had helped develop the formulation, offered to do the production formulation himself, to reduce costs over the large packaging companies and to protect his proprietary rights on the formula. We were then able to get the retail distributors to lower the normal markup for the epoxy and get the retail price down to $24.75 per-gallon kit, which would add only $85.00 over the price of the low-cost system per airplane. Thus, rather than go thru the expensive process of determining and qualifying the required hardeners for the low cost resin to obtain the correct pot life times, we decided to not delay the program and to have the distributors supply only RAE.

At that time there were other individuals offering to supply builders with various materials and were sending samples for our "approval". We learned two things from this experience: (1) It is very time consuming and expensive to do all tests required to gain confidence in a given structural material and (2) there is a very wide range of quality and acceptability in many of the materials, particularly the foams. Now that we had just solved the glass and epoxy problem we had a foam problem. We were concerned that the homebuilder would be sold inadequate foams, totally in good faith, by outlets who did not understand the importance of the proper physical characteristics

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and of quality control. The only way we could assure the homebuilder of getting the right materials was to specify it to the distributors and follow-up to assure quality control. The foams also presented an availability problem, since only one plant in the United States manufactures the blue foam in the correct cell size and in large enough blocks. The PVC foam must be imported from Europe and is quite expensive (typical retail price for the blue and green is 50 - 60cents/bd foot; PVC is generally much higher).

With our mind at ease that the homebuilder would be able to get satisfactory structural materials, the distributors wanted to also make up a hardware and metals kit, to allow builders to avoid the hassle of rounding up the numerous other items. We felt this was a good idea but insisted that they retail any item individually.

Prices - as you may know, we had estimated that raw materials cost for a VariEze (less engine) would be about $1,400.00 and about $2,700.00 if you elected to buy a lot of the items prefab. We then set the plans price at five percent of the prefab kit price. The materials/prefab parts price estimates were too low due to several reasons: (1) availability problems noted earlier, (2) handling/packaging costs of the many small items, (3) stampeding inflation of these type materials and (4) our obsolete price lists. Every item ended up costing more than our estimate, except the landing gear struts and they went up fifteen percent last month.

As a result, the current price for raw materials from the distributors is about $2,200.00 and about $3,400.00 if you elect to get as much as possible prefabricated. Plans price is now four percent of the prefab kit price. You can still build an EZ, for a materials cost of about $1,700.00 if you don't count tools, upholstery, and if you do a reasonable amount of scrounging for items like instruments, wheels, hardware, etc. Almost daily we hear from individuals who have found A - 75 and C-85 engines for $1,000.00 to $1,500.00 with lots of hours remaining. So the $3,000.00 airplane is not impossible, just improbable! We have about $5,800.00 in N4EZ, including the 0-200 and a NavCom.

VARIEZE PARTS WEIGHTS

The following are average weights for items constructed from the VariEze plans:

CANARD (chapter 4)	16.7 lb.
Both elevons with weights	6.3 lb.
Each wing with fitting	34.0 lb.

TEST DATA

The following flight test data from VariEze N4EZ are presented for those interested. We will attempt to have a tidbit of this type in every newsletter **GRAPH OMITTED**

VARIEZE CONSTRUCTION HINTS

In general, builder's acceptance of the construction methods has been excellent. We have received very little feed-back from anyone who felt that the building skill requirements were too high. Construction problems have been in two categories: (1) failure to follow or read the instructions in the plans, (2) errors or unclear areas in the plans. Category No. (1) will always be with us and can be avoided by following all the information in the plans carefully. Category No. (2) plans errors, are being cleared up due to the excellent feedback we receive from builders who contact us to suggest improvements.

Problem: The hot wire variable control shown in the plans is not only expensive, but has been discontinued by the supplier. The hot wire control can be any power source (AC or DC) capable of six amps (for .041 wire) or four amps (for .032 wire) and adjustable from about ten to eighteen volts. The following information lists several low cost units, and one which works great that you can build for about one dollar!

(1) Anderson Engineering Co.
2216 Foggy Bottom Road
Florissant, MO 63031
Kit # AS - 1 $17.99

This is an excellent control with an easily adjustable current up to eight amps.

(2) Most model train transformers are capable of powering a hot wire of .025 or .032 dia. stainless steel.

(3) A G.E. # OI - 61 ULO light dimmer (600 watt) control (about $5.00 in electrical supply houses) will power a .032 dia. hot wire. The control is quite sensitive and uses very small adjustments in the lower range of the dimmers range.

(4) The following schematic is all that is required to heat a hot wire using normal 115 - Volt house current. **SKETCH OMITTED**

Of course, a 30-foot hot wire is a little hard to handle, and the 115 Volt can give you a good jolt. So using the same principle you can make up the control as follows, using a 1 x 12 board, some wire (made from an extension cord), some nails, .032 stainless safety wire and an alligator clip. The wire is strung across 50 nails as shown, positioned up above the wood board. The alligator clip is adjustable from the 15th to the 25th nail to control wire temperature. Cover the 1st through 15th nails to avoid shock. The wire is hottest with the clip moved closest to the 15th nail. Be sure the wires are not touching the board. This system demands about 400 watts. **SKETCHES OMITTED**

Regardless of what control you are using, be sure to set the temperature as instructed in the plans, one-inch cut every four to six seconds with very light pressure.

The paper mixing cups can be reused, even with a large amount of hardened epoxy in them - just be sure to balance your scale to level before adding epoxy and hardener.

If you need to estimate the thickness of glass buildup for a particular layup, use the following values: BID = 0.013 inches-per-ply. UND = 0.009.

When mounting the template drawings for the wing foam cores, use a straightedge to assure that the level lines are straight. If you line them up referring only to the vertical lines, it is easy to get the rib

crooked. A good spray paper adhesive like 3M-76 prevents the wrinkling caused by waterbase glues.

Some builders have noted the full size center section spar pattern is about 0.1" shorter than the length indicated by the B.L. numbers. This is caused by an inaccuracy in the reproduction process and is small enough to be ignored.

When tacking the large blocks together for the wing cores, some builders have had the five-minute leak down in the joint far enough to hang up the hot wire. This can be avoided by laying a stick of wood across the joint and applying the five-minute to the stick, well away from the foam joint.

Be sure you are checking the temperature of your immediate work area with a thermometer. If you want to slow the cure a little, a fan directed at the part will help.

Important! Some builders have indicated that they inadvertently drilled into the tapped metal insert for the canard lift tabs. We have given them the following instructions to install nuts on the inserts. Also, if you are not positive that you have good full threads on your inserts you should follow this procedure, which can be done even if the canard is completed. **SKETCHES OMITTED**

Note: The correction in the next section adds nutplates on the insert. If you have not installed the canard inserts yet (chapter 4, step 2), use the following procedure: line up the insert with the lift tab. Clamp together and drill the three 1/4-inch holes. Mark the inserts and tabs (top, front, right) so they don't get flipped over or reversed. Mount a K1000-4 nutplate behind each hole. Fill the nutplate and hole in the insert with silicone rubber (GE or Dow silicone bathtub caulk). This keeps epoxy and micro out of the threads when the insert is installed. Let the silicone dry 24 hours before installing the inserts. Now install the inserts as shown in the plans. After the step 2 cure, follow this procedure to drill the glass pad: make a stop for your 1/4-inch drill to avoid the possibility of the drill slipping into the nutplate. Drill the center hole only. Install the center bolt and lift tab. Carefully line up the tab and using the tab as a drill guide, drill the other holes. Remove the bolt, prepare both surfaces for bond and install the three bolts and tab with wet flox. The bolts will push the silicone back on installation. The best quality holes in the glass pad can be obtained if the step 2 cure is allowed to cure two to three days before drilling. An alternate method is to use the plans procedure, but substitute 1/4-inch steel for the 1/8 inch aluminum inserts.

When routing the holes for the VECS3 brackets do not gouge into the spar cap. The bolts must be removed to install the VECS3's. One builder routed the hole forward to allow the VECS3's to rotate into the notch, and in doing so, removed 1/3 of the spar cap! He had to replace his spar cap, full span.

Be sure the elevon slot in the canard is correct and true before skinning the canard bottom. Warps or high places may limit up-elevon travel.

When slicing the cross-fibers during the spar folding layup, use a new sharp razor blade. Make a light pass over the fold with the blade held as shown. Then use your brush to stipple the bubble down. Do not stroke the brush on the surface, all stippling is done as a vertical stab at the surface. This vertical stabbing motion is the majority of work in building an EZ. Brushing on resin builds up weight. Adding a little resin in a vertical stabbing motion is much better. If proper stippling is done, very little, if any, squeegeeing is needed.
SKETCH OMITTED

Shelf life of RAE is two years unopened or one year after opening container. Both are for storage at room temperature out of sunlight. Do not store urethane foam in sunlight.

Do not be concerned that the elevon template is thicker than the elevon core. This accounts for the normal reduction in core size due to 'burn down' in the hot wire cutting. Excess can be trimmed before skinning. Check the fit of the CS2 brackets before glassing the bottom. They must line up well to allow the elevon to rotate smoothly without binding or stressing the VECS3 brackets.

We understand there is a wide range in sensitivities of bubbles in levels, ie., 1/2-bubble in one level may be twice the angle as 1/2-bubble in another. Be as precise as possible in setting wing twist and relative incidence. The relative incidence measured at the mid-span point must be within 0.1 inch over the length of a two-foot level. Do not reverse the level when checking right to left wings - this allows level inaccuracies to effect relative incidences. There is no room to be sloppy here; the twist and incidence of the wings must be set accurately.

A couple builders have reported that the glass build up on the wing fittings has been too high, such that even without the tolerance pads, the last ply is higher than the WA8 tongue (page 6 - 8). This is due to one or both of the following: (1) Inadequate stippling/squeegeeing on the pad/ spar/skin layup causing an overly wet, thick layup. (2) The Brock wing fittings have a WA3 tongue which is about .015 undersize due to a machining operation. This is equal to one ply of BID. Thus, we recommend that if you are using the Brock fittings, you reduce the pad by one ply and carefully squeegee during the layup. If you do come up high, do not cut away the skin, it must be continuous under the wing fitting. Make an aluminum spacer from some aluminum sheet and install it between WA3 and WA1 to fill the gap caused by a high layup. A high layup due to excess epoxy can be lowered by applying pressure on the top plate if the layup has not started to cure. This is possible if the layup is done below 75 degrees f and with enough people so it can be completed within three hours. Never attempt any layup below 60 degrees f, since the higher viscosity of the resin will make it more difficult to wet out the cloth. A good quality layup is difficult to achieve below 65 degrees f.

A preferred method to potting the electrical wires in the wings is to install a conduit, then push the wires thru later when needed. The conduit can be thin-wall alum or plastic tube, 1/4 or 5/16 dia. Only two #18 wires are required per wing, since strobes should be mounted on the fuselage (one on top behind canopy and one on the bottom near the nose wheelwell).

Formica scraps or masonite make excellent material for templates.

Do not over tighten fasteners. Correct torque valves are #10 = 20 in lb., 1/4 = 60 in lb., 5/16 = 100 in lb.

Drill a small hole through two 1-inch lengths of 1/2-inch diameter dowel and thread them onto the hot wire. This allows you to grab the wire immediately adjacent to the template for better control during hot wire cutting. Remember, the wire must be as tight as possible and speed must be slow around the leading edge to avoid lag undercuts. A leading edge undercut as much as 1/8 inch is acceptable and can be trued up with a long sanding block after the core is jigged.

Never make a glass layup over a core that is not straight and smooth. The glass panel cannot take the loads if it has bumps, depressions, steps, etc., in excess of the allowable values. Always check your core shape and size with the section drawings in the plans to assure they are formed and aligned properly before laying glass over them.

The main gear leg as received from Jiran looks twisted. This is due to the combination of the forward sweep and camber angle. If you want to check the toe-in before mounting the gear, set it upright with the end leading edges 4 inches forward of the center leading edge. Check the toe-in on a horizontal plane. It should be slightly toed in, but not more than 2 degrees. Adjustments can be made with a coarse sanding block before mounting the axles. Make the final adjustment after the gear is mounted.

Microspheres can be put in a large spice shaker for convenient dispensing.

The trim required to adapt the Cleveland brake to the strut is shown in the following sketch: **SKETCH OMITTED**

The dimension shown should be checked on the canopy when jigging it to the blocks on the fuselage (top of Page 22-2). Adjust the forward blocks if required, to attain the 12-inch height shown. In no case should this dimension be less than 11.5 inch. This would impair forward/downward visibility during climb and landing. This dimension cannot be determined by measuring the canopy as received from Cowley. The canopy is blown into a frame that is 20 inches wide at the front and 19 inch wide at the rear. The canopy is then bent inward to a smaller width when it rests on the blocks. This causes its height to increase in the center. Do not attempt to bend the canopy in until it is trimmed as shown in chapter 22. **SKETCH OMITTED**

Refer to the following drawings for installation of the kick-in step. Refer to the Owners Manual for details on use of the step. First, cut a 4-1/2" long by 3-1/4" high hole in the fuselage side just above the lower longeron and just aft or forward of the seat belt mount. Fit the side pieces (16-1b PVC) and top piece (1/4" ply) into place after removing enough foam. A short piece of piano hinge is bolted to the plywood insert and riveted (1/8" pop rivets) to the door. A small

compression spring, (attached on each end to the door and to an aluminum bracket with safety wire) closes the door when your foot is removed. **SKETCHES OMITTED**

The following is a simple way to check the pot life of your epoxy and give you a feeling for the importance of mixing batches of epoxy only as you need them. Be sure your resin and hardener are at 75 deg F. Mix about 5 oz of epoxy, stir well and leave the cup undisturbed at 75 deg F. Be sure you use the supplied 8 oz cup. The fast epoxy should exotherm, reaching a solid block in about 30 to 40 minutes. Slow epoxy should be solid in about 60 to 90 minutes.

WING FITTINGS - Before you bond the fitting permanently to your wing-spar foam core (chapter 6, step 3), trial fit the whole wing foam core (with the fitting) in the jig. The fitting should fit flush with the inboard edge of the foam core. Check the positioning of the spar core carefully and make sure that the spar trough top and bottom is deep enough to accommodate the spar cap layup. Use the section views of the completed wing on pages 6-18 through 6-21. Make sure that the fitting is on the spar foam core straight and not cocked off to one side vertically or horizontally.

Exotherm foam damage - care must be taken to avoid heavy buildups of epoxy/micro down inside a joint that is insulated by foam, such as on the assembly of the wing cores and on the winglet mounting. The gap to be filled by micro when assembling any foam cores should not be thicker than 1/16 inch. If you try to fill a gap greater than 0.1 inch you will be adding excessive weight and, more important, the large mass of epoxy-micro, insulated by the foam, can exotherm. Heat resulting from exotherm can be as high as 450 degrees F, which will melt away the foam locally and destroy the joint. On the winglet attachment (chapter 24, step 3), wait about an hour before doing the last paragraph on page 24-2. This allows the inside layup to partially cure before installing the extra micro and green block. Feel the inside layup before installing the block to assure it did not get hot due to exotherm.

Any time an exotherm is suspected, by an expansion of the epoxy at the surface or by the epoxy at the surface getting hot during cure, the joint must be inspected for exotherm damage.

It is good practice to not only keep the gaps small, but to do large block assembly below 70 degrees F. Always use RAES on core assembly or any large-mass potting; it was specifically formulated to eliminate an exotherm. Do not substitute RAEF. The photo shows a comparison of F and S joints. Note the form damage caused by the exotherm deep in the F joint. **PHOTO OMITTED**

WORKMANSHIP AND QUALITY CONTROL
In section I we gave you detailed information on specific defects that you may find in your work and how to repair them if necessary. We went into details there and don't need to repeat them here, but it does seem appropriate to make a few comments of a more general nature on workmanship. There is no substitute for good workmanship, and no excuse for poor workmanship. We've made an effort at making the materials and techniques as easy as possible for the beginner to do well, but nothing as complex as an airplane will ever be completely idiot-proof. All of you will make some minor mistakes in the process

of building your airplane and this is perfectly normal. There are also, unfortunately, a few of you who will make serious mistakes and lots of them. All of you must remember that you are your only quality control and nobody else can do it for you. If you have questionable parts you are burdened with the decision to scrap them or use them. If you are lucky enough to have another builder nearby let him look your project over and respect his opinion of your workmanship. If you find that another builder in your area is doing poor work, please have the courage to tell him so. If we help police each other our safety record will improve and we'll be able to preserve our lenient rules. Sometimes it is hard for us to admit to ourselves that an expensive part is really junk and a second opinion may help us to decide.

Remember, a wrinkle, depression, or bump in the layup which is greater than 1/16 inch high (or low) and which is more than 20% of the chord length or 20% of the spar chord is not acceptable and requires repair. A depression can generally be repaired by filling with flox to level and laying over the entire depression the amount of glass that is underneath, lapping outside the depression a distance equal to one inch per ply. Be sure you don't layup a depression or bump in the thick main spar caps. The transition of the spar caps into the wing fittings must be smooth and without joggles. The above applies only to the flying surfaces. The fuselage and fuel tanks can have relatively large depressions or bumps without effecting structural safety.

Be aware during the finishing process that you are sanding on your structure. If a bump or corner exists it is very easy to sand through more than one ply. Removal of more than one ply in the following areas requires repair: wing, canard, winglet (more than 20% of chord) and center section spar corners or shear web (be especially careful sanding near the wing fittings).

VARIEZE PLANS CORRECTIONS/CLARIFICATIONS
We've got a lot of corrections this issue, because there are already several people who have built most of the airplane from original--edition plans, all since the last newsletter. Most of you already have most of these changes since they were sent back with license agreements and included with shipments of materials from the distributors. Several of you will also be working with original--edition plans for the last half of the project between now and January when the next newsletter is due. So, keep your eyes open for errors/omissions in the plans and keep us informed if you find them. Those of you who are working on the second-half (chapter 15 on) between now and January should send us a self-addressed stamped envelope. If we find important changes before January we will make copies, stuff your envelopes and send them out immediately. Be sure to mark "PLANS CHANGES" on the outside of your S.A.S.E. Do not send the envelope unless you are actually working past chapter 15.

Now - grab a pencil and make the following corrections in your plans.

PAGE/ITEM	
5-4, Step 6	Clarification - The notch in the canard to accept the mass balance weight consists of removing the bottom skin and the foam. Do not remove the top skin.
9 - 2, BKHD	16.5 dimension should be 18.1. If

you have already made it 16.5, do not reject it. The space can be filled with a 3-ply BID tape after chapter 11.

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5 - 5, Balance check	20 to 30 should be 10 to 25 deg.
16 - 1, Bracket	1.75 dimension can be revised to 1.6 to allow this part to be fabricated from the 2 inch angle supplied by Aircraft Spruce and Wicks.
16 - 1, Belcrank	Lower hole should be # 12 drill. If you have already drilled it out to 1/4 inch, use a 1/4 inch bolt when mounting the cable in chapter 19.
17 - 1, F.S.	F.S. 2.0 should be F.S. 2.15.
17 - 8, View AA	VECS 13 should be NG 13.
4 - 3, 4 - 16, Inserts	Install nutplates, three per insert over holes drilled in place with lift tabs, see 'building hints' in this newsletter.
2 - 2, Hardware	Add six K1000-3 nutplates and 12 AN426 - AD3-5 rivets.
2 - 3, Chapter 10	9.6 should be 0.6.
5 - 6, VECS2	Only one of the two aft rivets are required. See page 5 - 5.
5 - 3, Center	Trailing - edge micro fill is incorrectly shown on the top of the elevon. Should be on bottom as shown on the top of the page. Ditto for page 5 - 6.
5 - 5, 5 - 6, Weights	CS11 lead weight size is 0.6 x 0.8 x 2.0. CS10 is full size as shown, 0.8 wide.
6 - 11, 2 - 2 and 2 - 3	AN 525 - 416R - 16 should be AN 525 - 416R - 14. If you have received - 16 screws from Aircraft Spruce and Wicks, return them for -14 screws.
16 - 2, Page nos.	The missing page numbers refer to the drawings on this page (16-2).
7 - 1, 7 - 2 Winglet	Clarification: The dimensions at the top of page 7 - 1 are to rough out a block to use for the winglet. Trim the block to the dimensions in the center of the page and on page 7 - 2 to obtain the correct winglet size. 103 deg should be 103.7 deg.
6 - 16, Template D	The notch which extends from talking number 11 to about 6.2 should extend another 1/2 inch

	to talking number 5.2. This allows the wing fitting to slide in another 1/2 inch to its correct position on the wing. **SKETCH OMITTED**
2 - 2, 2 - 3, UND	Add eight yards to the total amount of UND required. Most of the shortage was due to an error in the chapter 4 estimate.
3 - 9, Step 6	'Resin' should be 'epoxy'. Also page three - ten step 7, and page three - seventeen. Plain resin is never used for anything.
2 - 2, Nuts	'AN 316 - 3' should be 'AN 315 - 3'. Distributors made this correction before shipping any hardware.
2 - 2, Tubing	List shows two pieces, seven feet long for 1 1/4-inch tube. To avoid large cut-off waste, distributors are shipping one piece 66 inches long and one piece 84 inches long.
2 - 2, Foam	Urethane green foam (Uthane 200) is no longer being produced. Distributors are now stocking Uthane 190 or Uthane 210 which is a light tan foam. Do not substitute trymer or 9005.
6 - 5, Pads	The 4" x 6" pads should be 2-1/2" x 6". The pads on 6 - 7 and 6 - 11 are correct. They can extend beyond the fitting. The sketches on page 6 - 4 do not appear to show the wing fitting at its 25-degree angle. This is shown correctly in the sketches and photos on page 6 - 5.
8 - 5, Pads	'22 plies' should be '40 plies' and '25 plies' should be '46 plies'.
6 - 8, Spar cap	Clarification: The photo at the top shows the cap extending out onto the outboard core farther than it actually does. The photo was taken for the top layup (step 8), in which the cap is longer.
7 - 3, R4 Angle	Substitute the following pattern for the R4 angles. Two are bent up, two are bent down. **SKETCH OMITTED**
22 - 4, Top sketch	Arrow from 'plexiglass' is incorrect.
5 - 5, CS3/CS11	The CS11 weight interferes with the CS3 bracket before full trailing-edge down travel on the right elevon; either mount the CS11 weight out

further on CS12, or take your Dremmel and grind some material from CS3 and CS11 to allow full travel. The CS11 weight should strike the bottom of the canard about the same time as the CS10 weight strikes the top skin inside its cut out.

Owners Manual — Owners Manual page 40, top. Add 'recheck torque of prop bolts after first run, after 10 hours and each 50 hours thereafter'. Also the table on page 33 (sample weight and balance data) is incorrect. Substitute the following. The most desirable empty cg position is at F.S. 110.

ITEM	GROSS	TARE	NET	ARM	MOMENT
RT M.	275	0	275	108.0	29,700
LT M.	276	0	276	108.0	29,808
NOSE	8	-1	7	17.0	119
BALLAST	-25		-25	40.0	-1000
TOTAL			533	110.0	58,627

1 - 1, 1st paragraph — Some early sets of plans omitted page count. Add 153 and 9.

5 - 6, CS2 — Material call-out omitted. This is not a VariEze part to make. If you want to homebuild it, use the full size drawing on page 5 - 6. The pivot with bushing must be 0.1 to 0.15 forward of the centerline of the elevon tube when the bottom of the elevon is level. The flange is 0.6 wide. Use 2024-0 0.63 thick and heat treat to T3. When mounting CS2 to the tube a washer may be required under the nut on the one that does not sit on the canard glass skins.

3 - 11, Glass taper — Slope of taper shown as 2-1/2 inches per ply should be 1-inch per ply (2 1/2 c.m.).

5 - 6, CS12, CS 3 — Material callout omitted. Fabricate from .125 thick 2024-T3, Full size pattern shown.

2 - 2, MISC — Nyloseal tubing (46 ft,) should be 3/16" x .025 Polypenco Nylaflow tubing (46 ft.)

20 - 2, YT 3 — The drawing shows this piece 1.7" long on one leg. Revise the drawing to 1.5" so the piece can be made from the supplied extrusion angle. **SKETCH OMITTED**

6-17, Wing Fittings	Material callouts omitted. All material except WA4 is 2024-T3. WA3 tongue is 3/8 inch plate, milled .003 thinner than WA5 to provide clearance. WA2 and WA1 plates are 1/8 thick. WA6 plates are 0.063 thick. WA7 tubes are 1X.035. Overall height to outside of WA1 plates is 6.0 inch. Scale other dimensions. WA4 pins are 4130 heat treat to 120KSI. Taper is 10 degree included angle. Top pins are drilled 1/4 inch. Bottom pins are tapped 1/4 X 28. The #10-32 tapped holes in WA3 should be only .35 deep. Use bottoming tap. Long bolt may have to be -51 length depending on tolerance accumulation, or an SAE grade 8 bolt can be substituted which has a longer thread length.
5-6, Tip Fairing	The small cosmetic fairing at each canard tip is not shown on the plans. This fairing is attached to the canard and fills the one-inch void outboard of the elevons. Shape is not critical, just be sure it doesn't rub on the elevons. See sketch below. **SKETCHES OMITTED**
21-4, Step 6	While your composite fuel tanks are less susceptible to condensation than a metal tank, they can still be contaminated with water from the fuel truck. The low point water drain (section IIA) will drain water only if the aircraft is in a level attitude. Since the airplane parks nose down it is recommended that drains be installed in the forward tip of the tanks as shown. It is preferred to install them during step 6, however, they can be installed (without rivets) after the tanks are closed out.

SKETCH OMITTED

After inside layup cures, remove foam
and install 1.5" dia 1/8" thick

aluminum plate with wet flox and four pop rivets. Glass 1 ply BID over rivets. Drill and tap 1/8-27 NPT. Plug to avoid contaminating tank. Glass outside as shown.

One builder interpreted the cross-hatched lines on the five shear web plies on page 4-4, as being individual strips of cloth! The shear web is, of course, five pieces sized as shown; the cross-hatched lines just verify fiber orientation.

A5 Gearmount — The landing gear mount extrusions are shown with incorrect separation between pairs. Both pairs (per side) should be separated 0.625 (5/8 inch). When installing the extrusions on page 10-5 (step 4), bolt the individual pairs together with a 5/8 inch spacer between them before drilling them into the fuselage sides, to assure alignment for the gear bolt holes. When installing the gear on the fuselage (page 18-3) if there is space left over in front or back of the tabs, fill this with an AN 970-4 washer or an aluminum shim. **SKETCH OMITTED**

8-2 Spar size — Due to the spar front and back pattern being slightly oversize and to the possibility of growth in height in assembly of the center-section spar, its thickness should be checked after step 2. This is necessary to assure fit to the fuselage longerons and to the engine mount. Locate B.L. 7.5 on either side of the centerline. The height top to bottom should be 8.2 inches at B.L. 7.5. Sand the top and bottom surfaces equally to attain the 8.2 dimension, fairing smoothly into the outside contour at about B.L. 23. Don't make waves, gouges, or notches in the foam to assure that the spar caps will be laid up straight. **SKETCH OMITTED**

10-2 Longerons — The distance between the bottom of the top longeron and the top of the short longeron is 8.5 inch. This is not clearly shown on page 10-2, but can be determined from A5. **SKETCH OMITTED**

We have been advised by FAA that our registration numbers must be horizontal, not vertical as they have been. The numbers will have to get smaller to stay on the winglet but I guess that's ok. Strike the reference to vertical format on page 1 - 5 of section I.

PUBLICATIONS
There is an excellent VariEze article in the November "Private Pilot" magazine, which covers some previously unpublished information on the program.

The October "Sport Aviation" has some VariEze photos and a writeup on our Oshkosh trip. "Sport Aviation" is the official magazine of EAA, and can only be obtained through membership with EAA: Experimental Aircraft Ass., Inc., PO Bx 229, Hales Corners, Wi 53130.

CP10, Page 6

6-1 and 6-2, Step 1	Step 1, wing foam core cutting has several obvious errors - VariEze wings sweep aft not forward! Replace step 1 with the revision shown here. You will cut 4 cores in the following sequence: RT OTBD, LT OTBD, RT INBD, and LT INBD. Each of the large blocks has one left and one right core. On page 6-12 through 6-15 are patterns for A, B, and C. The flip sides are X, Y, and Z, respectively.

STEP 1
HOT WIRE CUTTING THE WING FOAM CORES

This step will take about two hours. You need an assistant for hot wire cutting. First make the three airfoil templates A, B, C and the two spar templates D, shown on pages 6-12 thru 6-16 from plywood or sheet metal. While you're doing woodwork, make the three jig blocks E, F, and G shown on pages 6-12 thru 6-15 from 1/4 plywood. Lay two of the 9x18x67 blue foam blocks out on your work bench and nail together as shown. Remember that templates X, Y, and Z are the flip sides of A, B, and C. **SKETCHES OMITTED**

Carefully hot wire trim the blocks to the dimensions shown. Position the templates for the outboard right wing core as shown. Careful positioning is required so that enough foam is left for the inboard wing and winglet cores. **SKETCHES OMITTED**

Cut the core. Go slowly around the leading edge: pause at the marks. Don't rush the wire. **SKETCHES OMITTED**

Pull the templates off and set the whole block aside. Get the other blocks, assemble, and trim them as shown. **SKETCHES OMITTED**

Align and level templates Y and C as shown (Y is the flip side of B, Z is the flip side of C). Cut the left outboard foam core. Now, modify

template B and Y by carving out the spar trough as marked on the template. **SKETCHES OMITTED**

Flip the foam block over and position template A and Y as shown. Cut the inboard right foam core. **SKETCHES OMITTED**

Now, set the finished cores and remaining foam block aside and put the first foam block back on the table. Locate the X and B templates as shown. **SKETCHES OMITTED**

Now, cut the inboard left-hand core. Go slowly around the leading edge, pause where indicated. Before you remove the foam cores from the block, mark the waterline on each with a ball-point pen. **SKETCHES OMITTED**

Don't throw the remaining block of foam away. Store it for use in chapter 7.

NOTE: Check vertical placement of templates to allow cores to be cut out of the block without interference.

COMPOSITE STRUCTURE The photos show what's left of a sample we took to Oshkosh as a comparison between our composite and a typical all-aluminum structure. The sample consists of an all-aluminum wing, which was originally built for the canard of the Mini-Viggen (this aircraft was never completed). On the end of its stub spar we built a glass/foam/glass structure with core, spar and skin similar to the VariEze canard. We designed the composite side to be equal in weight; it came out only slightly heavier. At Oshkosh we placed a block of foam under each wingtip and asked people to walk on the combined structure. The metal wing failed at mid-span the second day. The structure was walked on during the remaining part of the show and then shipped via motor freight to California with only a cardboard cover. As you can see in the photo the metal wing has severe permanent damage in its skin surface, trailing edge spar and ribs. Under load its contour looks more like a wrinkled paper bag than an airfoil. The composite side is undamaged. Even the Texas boots on the trailing edge did not cause failure or distortion of contour. Of course, we do not recommend you walk on your aircraft wing. **PHOTOS OMITTED**

A breakdown of the sandwich core in an area on the side of the fuselage on N4EZ occurred and was noticed on the trip to Oshkosh. At first we thought it was a skin delamination, since it looked like the skin had pulled away from the foam over an area of about 3" X 6" on the fuselage side adjacent to the throttle. Closer inspection revealed that the foam had deteriorated in the local area, rather than the skin pulling away. This was in an area where the foam was only about 0.1 inch thick due to the inside contouring around the throttle. So, with only a thin core in this area, the sandwich was not rigid. If you pushed hard on it it could flex, and thus over-stress and deteriorate the urethane foam. This area was repaired on-the-spot by drilling a hole at the top

and bottom of the effected area and injecting epoxy in the bottom, allowing air to escape out the top hole until the void was full. This stiffened the originally flexible area and made it much stronger than before. The minimum core thickness on the plans over a wide enough area to allow flexing is 0.3 inch, so unless you beat on the skins you should not experience this problem. If you have overcontoured the inside skin such that you have a thin core over a wide area you can remove all foam over a small area as shown, before glassing the outsides, to relieve foam stresses due to flexing loads. This technique is already used in the plans in two areas (section A-A, B-B, page 12-2). **SKETCH OMITTED**

The Blue foam and PVC foams, due to their inherent elasticity are not as susceptible to fatigue as the urethane. We do not recommend any changes due to this experience, since they should not occur in an area or in a fashion to cause any dangerous structural weakness. Just don't beat on your airplane like we do to show its durability. Keep your eye out for any deterioration, which is detectable by skin flexibility or contour variances, and repair by injecting epoxy. A glue gun, available at any model hobby shop is ideal for this purpose. Above all, do not make substitutions in foam types. There are urethane foams on the market with only 1/2 the fatigue strength of the EZ Foam.

We get an occasional question on how the structure will behave at extremely low temperatures! The answer is we frankly do not know, but based on available information we do not expect cold temperature problems. The coldest N4EZ and N7EZ has been is minus 15 degrees C (in flight at altitude). The glass sailplane people are not aware of any cold-related problems. The flying surfaces, with all load-carrying structure at the surface are not as susceptible to thermal stress due to rapid temperature changes as are many other designs. According to materials specifications and the guidelines in the "Advanced Composite Design Guide" the structure should experience no adverse effects to below - 50 degrees F. There are several EZ's being built in Alaska. Any information they can add will be published in the "Canard Pusher." If you are concerned about a different environment (cold, humid, salty, etc.) in your area or anything unusual, you should conduct the appropriate tests to satisfy yourself of the adequacy of the product. It is, of course, impossible for us to provide all the answers, but we do our best to expose the airplane to as much testing as possible and have, and will continue to, publish any problems encountered and their solutions.

We have had a number of requests for loading data from individuals wanting to proof-load their surfaces, and from those seeking Foreign approval for the design. The accompanying data are the limit spanwise loads (5-g) and are for the worst-case cg conditions, aft cg for the wing and forward cg for the canard. Also shown is a convenient way to proof-load your canard, using a foam block and some friends. Don't do this by merely hanging it from the lift tabs. It must be supported (as on the fuselage) at the trailing edge to keep from bending the tabs. Also shown is our test of the complete wing and fitting, loaded to twice limit loading with shot bags. This load is equal to twelve 170-lb people. While demonstrating limit loads can give you a great deal of confidence, it should in no way be a reason to accept a part with poor workmanship. **GRAPH AND SKETCH OMITTED**

FAA COMPOSITE STRUCTURE INSPECTION
We have reprinted the inspection criteria that was distributed to the FAA GADO's, EMDO's and AEDO's in this newsletter for your information and in case your local inspector missed out on the distribution. You should contact your local inspector before you actually build much of your airplane. The sequence of inspections and at what items he wants to see are his own choice. Some of you early birds may find that you have the Feds looking over your shoulder pretty often until they get up to speed on the construction sequence. See page 14 of this newsletter.

In some places the local FAA inspectors have asked to see the wing shear web before assembly of the wing foam core. We don't recommend this because if the shear web layup is allowed to cure before assembly of the foam core it must be sanded dull for bonding later. The sanding process may damage the surface plies of glass, result in an inferior part to one wet bonded. If your local inspector insists on seeing the wing shear web, try to have him there to inspect it wet. If you can't arrange this, add an additional BID shear web ply full length on the fore and aft faces to be sanded after cure. Be super cautious that your shear web box isn't bowed while it cures.

FOREIGN BUILDERS
There is quite a bit of interest in the VariEze around the world and we have a few words of caution for potential overseas builders. Government regulations and limitations on homebuilts vary quite a bit from country to country. Please check with your local authorities before ordering plans, since we can't refund plans orders if you find out later that the VariEze is not approved for construction in your country or that materials are prohibitively costly or unavailable.

The shipping costs to some areas of the world are over $1300, making the costs prohibitive for many potential builders. We are looking into the availability of acceptable substitute materials. We have found that the foams are not available at all in some countries. One builder in Germany has reported success in substituting Rohacell for the 2 lb/cubic feet blue styrene foam, however, it's high moisture absorption makes it suspect. If you are searching for substitutes do not accept any material which has lower strength or other physical properties than the recommended materials shown as follows:

Blue Styrene:	Dow Chemical Co. Brand F.B. Styrofoam, 2 +- 0.2 lb/cubic feet density, cell size 1.4 to 2.4 mm.
Green Urethane:	Upjohn Chemical Co. U-Thane 200 or U-Thane 210 or U-Thane 190
Ridgid P.V.C.:	Conticell equivalent densities are available in Europe.

ENGINES 0-200-A Pusher installation in N4EZ has a total of about 150-flight hours to date. There has been no measurable increase in crankshaft end play which would reflect thrust bearing wear.

Everything looks good for the 0-200-A on the VariEze aircraft. Do not conclude from this that the 'A' model engine is suitable in other pusher aircraft. Look at your owners manual for the technical discussion on thrust loading. A.C. BOYLE, chapter 40 Designee, and A & P rated mechanic has been kind enough to offer some suggestions to those of you who are overhauling or servicing small Continental engines.

If you are overhauling an A-65, convert it to A-75. The conversion is covered by Continental service bulletin M47-16, revised 9/25/68.

Install the 100 octane valve conversion when overhauling any of the small Continentals.

Pistons, rings, valves, valve guides, rocker arm bushings, rocker arm pivot pins, and bosses on the cylinder heads should all meet new tolerances not service limits if you expect to get the full TBO.

Never have crankshaft grinding done by an automotive shop. Stick with an FAA approved regrind shop. The bearing journals on aircraft crankshafts have specific requirements that auto machine shops generally don't have the equipment to meet.

If you want to convert to slick 4000 series magnetos use slick kit #M2640 which gives the mags and hardware. Continental part #36066 drive gears are used with these magnetos.

Have your inspection (Magnaflux & Zyglo) and machine work (grinding and plating) done by a competent aircraft machine shop. Don't take chances with amateurs.

If you plan to store your newly overhauled engine over 90 days don't test run it until you're ready to put it in service. The combustion products from the run-in will cause corrosion internally. If long-term storage is planned, oil all internal surfaces on assembly, plug all openings (breather, oil pressure port, intake, and exhaust openings), and install desiccant spark plugs.

Follow the service manual's recommended run-in procedure.

Regarding the use of 100LL fuel in the low compression small continentals. If adequate (100 octane) valves are installed, plugs cleaned every 100 hr., and oil changed every 25 to 30 hours, no appreciable degradation of engine dependability should be experienced as a result of 100LL use.

VW ENGINES

We have been talking to a number of "high time" VW flyers over the last few months and the story we hear is generally one of woe and poverty. The message that we get, even from successful bug operators, isn't very enthusiastic. One high timer (800 hour) said that there were probably ten other guys who had suffered failures with VW's for each successful operator. He is using a Continental C-85 in his VariEze. Another bug operator we talked to said that in the 240 hours he was able to operate before failure, his VW cost him more dollars than a brand new 0-200 would have (at that time $3800), and he spent an hour with the cowling off for every hour he spent flying. The thing that scares us is that

both of these gents are very competent engine mechanics with plenty of troubleshooting experience and a trained ear for problems before they get serious.

On the other hand, we talked to a group of small-bore VW operators (36-50 hp) who had excellent service in motor gliders with very little hassle. Unfortunately the 36 to 50-hp engines, are too small to power a VariEze. Our present conclusion has to be that we can't encourage the use of VW conversions in the VariEze yet. We say yet because a number of development programs are underway and eventually the big-bore bug may become an aircraft power plant, but don't hold your breath waiting. If we were to recommend a VW installation currently, we would expect to see a lot of unhappy builders, a high percentage of maintenance troubles, excessive costs, and possibly some accidents. Beyond basic engine durability the VW converters are faced with devising and supporting a service bulletin and airworthiness directive (AD) system to support the operator. Frankly, Continental and Lycoming would not have the success record that they do without the customer support effort in service and overhaul manuals, AD's, and service bulletins. We do understand that the Limbach engine does have a functioning AD system and is one of the more reliable VW's around. Unfortunately, these engines are more expensive and harder to get than the Continentals.

There are some of you who are qualified mechanics, experienced with both VW and aircraft engines, and you know that you can operate a VW engine safely and reliably. If you want to build your VariEze without waiting for section IIB and a full development program, you can use section IIA as a guide and develop your own installation details. Efforts to develop and refine the big bore VW's are underway. One of the manufacturers will work on an Eze installation after demonstrating several hundred hours service in a Champ. We will monitor their efforts. If they prove successful and if they can provide adequate customer service, then we will publish section IIB. The earliest that this could happen is the summer of '77. We regret that IIB can't be published now but to do so would be an injustice to you, to EAA, and the accident record might jeopardize our lenient FAA rules. We will not accept orders for section IIB until a successful installation is developed. The VW installation we have in VariEze N7EZ does not have adequate reliability.

This is not to infer that the VW does not have its place in sport aviation. Its use can be justified in a low wingloading airplane such as a Volksplane or Pixie for recreational utility, and where a forced landing can always be successfully done. Those applications generally involve less than 50 flight hours per year and thus the cost per year for the first few years is quite economical.

LYCOMING ENGINES
We've received a lot of flack over our selection of the Continental engines for the VariEze since most models have been out of production for years. The most common question is "How about the Lycoming engines?" and this is your answer: They are too heavy. The 0-290, 0-320, 0-340, and 0-360 engines are totally out of the question.

The 0-235 models could be used only with some strict limitations. The normally equipped 0-235 is 242 pounds which is much too heavy both

structurally and from C.G. considerations. If the 0-235 is stripped (mags and carburetor only remaining) its weight can be reduced to 211 pounds which is marginal but can be lived with (as is the Continental 0-200 with alternator but no starter); the 0-235 has some advantages in lower cost, and it is available in a 100 octane-burning version. We haven't flown an 0-235 installation and it may not work out successfully, so don't rush out and sell your Continentals. Even if the 0-235 works ok, you would be restricted to no electrical system. A Vari-Eze program on the 0-235 is underway and it could become section IIC, but the earliest that this could happen would be next summer. The 0-235 produces too much horsepower and would have to be limited to lower cruise power settings. If you're unhappy about the available engines as we are, speak out! Write to your Congressmen (to Lycoming and Continental) and tell them to get on the stick and produce an 80 hp, 160 pound, under $3000 engine. The technology is available and if enough interest is generated, maybe we'll get some action. Get your friends to write and show the manufacturers how big the market is.

VARIABLE PITCH PROPELLERS

We haven't gotten too many requests for variable pitch/constant speed/adjustable props from our builders which is a tribute to their good sense and intelligence. However, for those few who have asked about them this is why we are down on them: safety, cost, weight, and maintenance. First, it is a very definite risk to install a variable pitch prop on a pusher aircraft. The development of a variable pusher prop for the VariEze could easily run hundreds of thousands of dollars and still be a failure. The cost of a proven variable prop, even if one were available would be over a thousand dollars each. The lightest controllable prop would weight about 25 pounds which would create a CG problem requiring ballast, further increasing the weight growth. The maintenance and upkeep required on a variable prop is unbelievable. Look through the FAA airworthiness directives for propellers, and you'll see what we mean. Even if you have money to burn, a fulltime mechanic on salary, and are a hairy-chested test pilot type anyway, you won't gain anything with your fancy prop. The added weight will limit your useful load. Even for gross-weight operation, the VariEze requires a larger airport for landing than for takeoff. Climb is excellent even with a fixed pitch prop. Thus a variable pitch prop would not increase utility.

TIGER VS. VARIEZE

Since I haven't flown anything but experimental types lately I wanted to fly another lightplane to get a comparison with the VariEze. So, last month I jumped in the Continental 0-200A-powered VariEze and flew to an airport in which I could rent a Grumman American Tiger, the 'hot rod' of the fixed gear lightplanes. I flew the 180-hp Tiger about 1 1/2 hours, including 5 landings, then flew the VariEze home; my impressions follow: Both airplanes taxied well, the Eze being easier to taxi in a direct crosswind. Both track well in the takeoff roll, the Tiger has higher stick forces required to rotate but both were easy to settle into climb attitude. The Eze rolled about 200 feet farther before lift-off but accelerated to climb speed faster. At the test conditions of 5000 feet altitude and 90 degrees F temperature the Eze had twice the Tiger's rate of climb (1200 fpm vs. 600 fpm). In level flight at the altitudes tested, the VariEze was about 30 to 35 mph faster than the Tiger at full throttle.

The VariEze is a more comfortable airplane to fly even though cabin volume is much less. The Tiger had to be constantly flown to keep it level in the light to moderate turbulence, whereas, the Eze could be flown hands-off using an occasional rudder input or trim adjustment. I

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had a tired back after flying the Tiger and wanted to get out and stretch. The reclined seat with thigh supports, armrests, and lumbar support in the Eze caused no discomfort. Cockpit noise levels were about equal. The Eze's ventilation was better.

The Tiger had a mild torque-effect requiring some rudder at the climb speed and the rudder requirement increased as speed was slowed to stall. Stall was preceded by ample natural stall warning and consisted of mild pitch bucking followed by dropping of the left wing. The Eze had no noticeable torque effect with speed and the increased stick force gradient at about 51 knots was ample warning that speed was low. At full aft stick the Eze could be flown and maneuvered without tendency to depart or drop a wing, even though the angle-of-attack was excessive and totally blocked forward visibility.

Cruise visibility of the Tiger was better than the Eze, particularly forward over the nose. Both airplanes have good pattern visibility, but the Eze's forward/downward blockage hindered a good look at obstacles during final approach.

The Tiger was easier to land than the VariEze due to several factors. If the Tiger was high on final, reduction of power could produce a high sink rate and salvage the approach. The flaps were quite effective but there was a significant pitch trim change for the first 15 degrees deflection. On the other hand, if the Eze were high on final, airspeed would increase in order to get down, even with power reduced to idle. Approach speeds used in the turbulent flight conditions were - Tiger 75-80 mph, Eze 80-85 mph. The Tiger could be flared up to the numbers and when power was brought back it would immediately settle on the runway consistently where I wanted it and I could stop repeatedly within the first 1400 feet of the runway with moderate braking, one required only about 900 feet. Touchdown scatter was considerably more on the Eze. The airplane does not lose speed or settle significantly when power is reduced; it merely flies down the runway with speed bleeding off slowly. Bringing the nose up to the horizon for touchdown resulted in a touchdown speed of about 65 mph, which was about 5 mph faster than the Tiger. Once I was able to put the Eze on the numbers, but more often touchdown occurred 400 to 500 feet down the runway, once about 1000 feet when the approach was about 10 mph fast. The Tiger with its larger tires gave a smoother rollout and braking was more effective, particularly when flaps were raised during rollout. My general impression was that a comfortable runway length for landing the Eze was almost twice as long as that required for the Tiger, when all factors were considered. On the landing I overshot, I didn't get the Eze stopped until about 2400 feet down the runway.

In summary, the VariEze definitely has the edge in range, economy, cruise comfort, and performance. The Tiger with four seats, more baggage, and IFR instrumentation certainly has more utility. Its

better ability to operate from short fields also increases its utility over a VariEze. The Tiger carries twice the number of people, but the VariEze can get 2.2 times the miles-per-gallon.

With the VariEze you should plan on using a minimum of 3500-foot fields for your initial landings and after your proficiency builds up you can work yourself down to as low as 2400-foot runways. Refer to the Owners Manual for specific ground roll and obstacle clearance distances.

The excessive runway requirements of the VariEze could be reduced if a drag device were deployed to dirty up the landing configuration. We do plan to test one after we get the remaining plan's sections out. Do not ask about the progress of this item, we work much faster when we don't have to respond to questions! Yes, we are designing it to be retrofittable. No, we don't know how much it will help, or even if it will be successful.

N7EZ DAMAGED
The Volkswagen-powered prototype aircraft that served as a forerunner to the VariEze was damaged last July in a landing incident. While this aircraft is considerably different than the homebuilt VariEze (N4EZ), its structure is somewhat similar. Thus, the results of the crash durability of this airplane are of interest to VariEze builders.

The airplane was landed in a soft dirt incline, approximately 400 feet short of the runway. The main gear failed aft at touchdown (N7EZ's gear sweeps aft, not forward as on N4EZ, and is quite weak for drag loads). The right wingtip drug into the soft dirt, yawing the airplane as it left the ground in a nose-high attitude. The yaw coupled to roll and the aircraft struck the end of the concrete runway at 60-degrees bank and about 30-degrees nose-down pitch.

First ground contact was the tip of the right canard. Rather than failing the canard, it was removed from the fuselage, taking some of the bulkhead with it. The canard then tumbled down the ramp, damaging the elevon trailing-edge skin. Damage to the canard was limited to a 3 inch by 6 inch area where it first struck the concrete. With the exception of the easily repaired area at the tip, the entire canard structure is undamaged. A metal or wood equivalent structure, striking concrete at that angle at 65 knots, would have been destroyed.

Next ground contact was the nose of the airplane and the wingtip simultaneously, with the aircraft still at 60-degrees bank and 30-degrees nose-down. Wingtip damage was limited to the lower winglet surface. The nose took the major impact energy and resulted in a buckling of the structure around the fuselage under the canard mount, as the entire nose section moved back about one inch (see photos). The airplane then slid down the runway about 200 feet on the nose gear and wingtips. The bottom of the rudders, prop, and both lower wingtips were damaged in the slide. The nose gear pushrod (NG10) buckled between NG1 and NG13. The landing gear strut was not damaged.

All structure not noted above was not damaged. The upper winglets, winglet attachments, wings, wing fittings, spar, fuel tanks, fuselage, cockpit, canopy, etc., were not shifted in any way. The engine did not shift, and there were no fuel leaks. The pilot received no injuries even though he had forgotten to put on his shoulder harness.

It is quite disappointing, of course, to have the aircraft damaged, but was encouraging to obtain impact survivability data that is very favorable to the structure. This was an area that was somewhat unknown. Many of the all-glass sailplanes have a history of shattering the fuselage structure in a crash. Apparently the sandwich of glass/foam/glass used throughout the VariEze provides energy absorption, limits the damage to local buckling, and provides good pilot protection.

VARIEZE QUESTIONS/ANSWERS

We still get an occasional letter asking a question, but without a self-addressed, stamped envelope enclosed. We will assume that if a SASE is not enclosed, the writer does not want his question answered until the next newsletter; so, if you want prompt reply, send the SASE. Questions about availability cost and delivery of items handled by a distributor should be sent directly to them, not RAF. The distributor can process your questions faster if you send them a SASE too.

Question - Is any of the material and hardware on page 2 - 1 duplicated on page 2 - 2?
Answer - No. If you homebuild the prefab parts you will need to get the materials and hardware separately.

Question - By experimenting, I have found that RAEF behaves similar to RAES if it is mixed six to one ratio. Is this o.k.?
Answer - No! Never change specified ratios on epoxy. Never do anything contrary to the education section of the plans without getting complete justification.

Question - I plan to put a starter, vacuum pump, alternator, complete electrical system, complete IFR instrumentation and lighting in my Eze. Where do I put the ADF antenna?
Answer - First of all, we do not recommend that you plan for IFR utility on any homebuilt. Get out your FAR part 91 and see that an experimental airplane can operate "VFR, day only, unless otherwise specifically authorized by the Administrator" (part 91.42). Some local FAA authorities will approve IFR or night capability, but many require specific approval for each flight. The important thing is that FAA can prohibit homebuilt IFR merely by discontinuing the 'specific authorizations', not by having to change a regulation. I feel this will happen the first time a homebuilt has an IFR accident, particularly in a TCA. So, it is foolish to tie up a lot of money in IFR equipment that you may not be able to use. If you must have IFR utility, we recommend you use a type-certified aircraft. Remember, a homebuilt aircraft must be built and flown for "education and recreation only." The current United States rules are the most lenient in the world and were written to accommodate local recreational flying only. I think the best way to keep our rules is to not try to over-extend their intent and to do our recreational flying as safely as possible. Night-flying a high wing-loading single-engine airplane is not considered safe practice. Secondly, you are loading up the wrong airplane. The VariEze has only 67 square feet of wing area and is thus effected much more by weight growth than a Cub or Flybaby, which has twice the wing area. You will be much happier with your VariEze's flying qualities, performance and safety if you operate it as light as

possible. The maximum engine weight is 215 lb., which does not allow use of the starter and generator on all of the Continental engines. Basic and accessory weights for all the Continental engines are shown in section IIA. Due to fuel system requirements you cannot use the engine-driven vacuum pump. If you must use a vacuum instrument, you must use a venturi to drive it. Remember, due to the aircraft's small size it is not adaptable to heavy installations. The 215 lb. value is an absolute maximum. The 170 lb, A - 75 is preferred, and was the design point. The A - 75 is probably the best engine for the VariEze. Now, back to your original question, the best place to put the ADF antenna is on a Type-Certified airplane.

Question - I am learning aerobatics. What maneuvers and entry speeds do I use for the VariEze?
Answer - You are using the wrong airplane. The VariEze was not designed for aerobatics and thus an aerobatic test program has not been done. To clear you for aerobatics, I would have to conduct a complete series of tests including inverted maneuvers, tailslides, 6-turn spins, expansion of structural maneuvers, etc. I do not plan these tests because I have no requirement or intention to clear aerobatics.

Furthermore, the introduction of an all-composite structure to homebuilding is a big enough step in itself, considering the wide variety in workmanship. It would be unwise to introduce a new-type structure in an aerobatic airplane, particularly one in which inexperienced aerobatic pilots would operate. This is not to infer that an all-composite airplane has no future in aerobatics. I just think it is wise to gain several years experience in a non-aerobatic airplane first. Do not exceed the placards/limitations in the owners manual. If you are considering aerobatics, do them only in an aircraft approved for them.

Question - I am a Ham radio operator. Can you set up a frequency and time for Hams to discuss VariEze?
Answer - Ivan Whitehouse, Goldendale Wash, reports they are using 3900 khz at 8:30 P.M. Tuesday nights.

Question - Is it possible to hit the wingtip on the ground during landing?
Answer - Yes. It happened to N4EZ once. I was making an approach to Dalhart Texas on the way to Oshkosh on a gusty afternoon. On short final the airplane had a very large turbulence upset. I recovered to level flight and continued the approach. In the flare for landing I encountered another large gust which drove a wing tip into the ground and gave me a very hard touch down. The landing was quite hard and due to the shock and noise I thought I may have broken the prop or gear. I taxied in and found that both lower winglets had struck the ground. Everything else was o.k. One of the lower winglets had been shortened about 1/2 inch and was split on one side. The other had been ground off about 1/4 inch. Repair was easily done with some 5-minute and a spray can of paint.

Question - I have enclosed a sketch showing my solution to hooking up a dual control setup on my VariEze so I can make it easier to check-out my friends. Will it work o.k.?
Answer - No. Dual controls for the VariEze are not as simple as just rigging a mechanism to the back seat. First of all, we are concerned that with dual controls many will be attempting to use the airplane as a trainer, checking out people who do not meet the qualifications shown in the Owners Manual. This goes for any homebuilt - get your basic proficiency in Type-Certified training aircraft. Do not risk EAA's safety record by learning flying skills in a homebuilt. A very large percentage of homebuilt accidents can be traced to a lack of basic pilot proficiency. Second, the VariEze's roll rate due to rudder is higher than that due to aileron, thus it is important that the back seat instructor has good rudder control. The back seating is arranged such that the passenger's foot sits flat on the inclined floor, making it difficult to provide good rudder pedal control for a tall instructor. Back seat controls would require a major structural addition to the fuselage and would eliminate one suitcase. When we do provide back seat controls we plan to also incorporate rear wing ailerons to improve the roll flying qualities, since if we're going to complicate the control system that much, we might as well go all the way! The rear wing aileron addition is a very major change that affects wing stiffness and would require extensive flutter qualification. Do not build a VariEze if you require dual controls (with the assumption that they could be worked out). They may not work. Do not ask how the dual development is working out. If it is successful details will be provided immediately.

Question - I plan on notching into the wing to make the roll trim tab flush. Is this o.k.?
Answer - No. Do not modify the wing. Changing its stiffness would require extensive flutter qualification.

Question - On chapter 6 step 9, which fasteners do you prefer?
Answer - The AN 525's are highly desired since the precision countersink operation is not required. Performance loss with the external screw heads is less than 1/2-mph speed.

Question - I know my VariEze elevons should go trailing-edge-up 27 degrees, but I got something crooked & mine hit the canard at only 25 degrees. Do I have to start over?
Answer - No. 27 is preferred, but you can accept as low as 24 degrees. If less than 24 degrees is obtained you will have to adjust CS3. Do not adjust CS2. The position of CS2 relative to the elevon is important to provide the correct stick forces.

Question - Can I get a list of those in my city who are building a VariEze?
Answer - We don't have a geographic list, but you can find other builders by speaking up at your next local EAA chapter meeting.

Question - I understand from an article by Glenn Sievert in the October "Sport Aviation" that Dynel fabric has better flexural strength, but less tensile strength than glass. I have some Dynel left over from another project. Can I substitute it for glass?
Answer - No. Mr. Sievert's "comparison" of Dynel and glass tensile strength which shows glass 2.6 times as strong as Dynel is very

misleading. He has selected equal cloth weights, but in fact, due to Dynel's thickness and "burlap" consistency, it results in a lamina that is 3.5 times as thick as the 100-gram cloth per ply, and proportionately heavier. In a correct comparison (in lb/square inch tensile strength) the epoxy/glass lamina is over ten times as strong as an epoxy/Dynel lamina. The foam core in his tension sample cannot be assumed to carry its share of the ultimate tensile strength due to the greatly different modulus of elasticity; ie., the foam will not be highly stressed until after lamina failure. His "flexural ultimate" test is not really a test of the lamina flexural strength, because due to his test setup, the compressive allowable stress of the foam core was reached long before approaching tensile/compressive allowables in the lamina. In fact that his .014 thick Dynel lamina spread the foam compression load over a larger area than the .004 thick glass lamina, resulted in a higher foam core buckling load for the Dynel. The Federal Test Method used could be done on a multi-ply lamina of Dynel or glass without the core and would result in the correct values of flexural ultimate for the material in which glass is again over ten times the strength of Dynel. If Dynel were used for the VariEze spar caps the caps would have to be over one-inch thick where the glass caps are only 0.1 inches thick.

AMATEUR DESIGNERS

Composite structure, as we have said many times, is not adaptable to amateur design practice. The simplified (sometimes eyeball) design methods that have evolved through the years of experience with steel tube, simple wood, and aluminum structure do not exist for composite structures. The structural composite is the baby of all aircraft structures and it will need the years of service experience that the older materials have had to mature before the common practice and "thumb rules" for amateur design evolve. Remember, steel, aluminum, and wood have had 40 to 70 years to mature as aircraft structural materials. Composites have scarcely even flown as primary structures. The best qualified engineers in the field are still arguing among themselves about the design criteria for composites, and if the true experts are still not set on the best approaches, the amateur shouldn't even try. If you aren't a well-qualified structural designer with a good composites background, don't even consider the use of composites in an original design of your own! Unfortunately, a few foolhardy individuals have already attempted to use composite structures in aircraft without adequate knowledge and the results have been catastrophic. In mid-July the prototype of a foam/dynel/epoxy airplane had a catastrophic in-flight structural failure. The impact killed the pilot/designer/builder but fortunately nobody else. The FAA's post crash investigation revealed errors in both design and workmanship that would give a competent composites engineer prematurely gray hair. Specifically, the full depth foam leading edge (about 30% of chord) was not structurally attached to the spar and incapable of transmitting shear loads to the spar. The only thing holding the first 30% of chord to the wing spar was the dynel/epoxy skin, and the skins had been virtually sanded through in pursuit of a nice exterior finish.

SHOPPING

The following individuals or companies have contacted us indicating that they have Continental engines for sale. We cannot endorse them since we haven't seen the engines, but we are referring you engine hunters to them as a possible source.

J.W. Duff Aircraft Co. - all types: A65-0-200
8131 3 40th
Denver, Co 80207
(303) 399-6010

Champion Aero Serv. - A65's
801 Airport Rd.
Springdale, Ar 72764
(501) 756-1760

Nathan Puffer - 0-200A, 875-hr SMOH
2182 N Payne
St Paul, Mn 55117
(612) 776-1145

Wes Winter - new 0-200A
6910 N Stardust Cir.
Tucson, Az 85718
(602) 297-4125

Ray Phillips - four runout A-75's/$450 each
291 San Bernabe Dr.
Monterey, Ca 93940

Radio Systems Technology now has a build-it-yourself VHF 2-channel (Heath kit style) radio for about $200. Looks like a real good way to keep operating out of your local airport after FAA moves their tower in. Contact them at Box 23233, San Diego, Ca. 92123.

George Evans and Bill Campbell now have VariViggen fuel tanks. The photo shows some of the VariViggen metal parts from Bill Campbell (next page).

Spraylat is no longer available in small quantities at the address in chapter 22. Contact Cowley for Spraylat.

Rich Steck (Eze S/N 662) has made up a handy logbook to serve as a complete diary of the VariEze construction to keep track of your materials and building times. It also helps organize FAA papers, changes and includes a guest register. He will sell you a copy for $3.50. Contact him at 536 16th Ave, N.E., St. Petersburg, Fl 33704.

Jerry Trump (VV S/N 313) has new Ford window-lift motors for $47 each, in shipset quantities. Also, LS-806 pulleys for $2.75. Contact him at 322 N Mountain, Monrovia, Ca 91016.

Jacket patches are not shown in the RAF product sheet. They are three inches high, three-color and consist of a shield outline with a planview of the airplane. Specify VariEze or VariViggen. They are $1.95 each.

I understand that Moorabbin Aircraft Spares, Box 68, Cheltenham, Victoria, Australia, has in stock many of the materials and hardware items for you Australian VariViggen builders.

Jesse Wright (see distributor's list) has made up a comprehensive list of parts and description with the prefab VariViggen wood parts he

sells. Those VariViggen builders who are just now starting construction should send him 50 cents for his list. Prefab parts can save a lot of work.

VARIVIGGEN ACTIVITY

N27VV made its annual flight to Oshkosh again this summer. The VariViggen prototype has flown to the EAA convention the last 5 years. It has undergone no modifications since the last newsletter. Flying time since newsletter No. 9 was only about 40 hours. No recurrence of last years landing gear problems have been experienced. The 0-320 Lycoming now has about 2000 hours since major, the entire run without problems or unusual maintenance. We did encounter a fuel problem on the way back from Oshkosh. The engine surging during descent that had occasionally been noticed (see newsletter No. 9) started to get worse. When the fuel starvation started to occur in level flight we knew something was wrong! Closer inspection revealed that the fuel screen in the gascolater was clogged with a green substance that appears to be the sloshing compound used in the fuel tank. There had been no breakdown of the sloshing compound (an approved zinc chromate type) over the previous 4 years. The airplane has just recently started to use 100LL fuel occasionally, so possibly a compatibility problem exists. We don't really know, but we are sure going to check our fuel filters more often. After cleaning the screen there has been no recurrence of the surging, even in steep descents. About 15 of those building the VariViggen got rides this year at Oshkosh.

VARIVIGGEN PLANS CHANGES

S.P. WING PLANS	Note caution on epoxy exotherm discussed in the VariEze section of this newsletter. Page 27-1.75 dimension should be 3.5.
Plans pg 5	AN4-21A (18) should be AN4-22A (46)
Plans pg 26	AN4-21A should be AN4-22A.
Plans pg 42	Some builders have found that RB2 interferes with WS30. Before drilling in RB3 check this and move inboard if required.
Plans pg 53	The wiring diagram results in the three green lights going off when there is weight on the gear (squat switch) (Harold Reiss I owe you a Coke!) While this is not standard practice it is actually a good system since the squat switch is checked on each flight and the "three green" indication on the ground can be checked by flipping the "squat-override" switch.

Harold Reiss (s/n 267)

Harold has finished everything but the outboard wings and canopy. He is using composite wings and rudders. He suggests stiffening the V2 channel when using the composite rudders, since they do not use full-span hinges and some local flexing can occur. Refer to the accompanying sketch. **SKETCH OMITTED**

VARIVIGGEN PROJECT REPORTS

Jim Cavis (s/n 31)

The two photos show (1) the front half of the two piece canopy. Sure gives his Viggen a better look than N27VV. (2) Jim's standard wing using composite construction. Note the shorter aileron span. The aileron will be balanced similar to those on the S.P. wing. If this configuration works, Jim plans to provide construction details in the second part of the construction manual, which may be available sometime this winter. By the way, Part 1 of the VariViggen Construction Manual was inadvertently omitted from the product sheet included in this newsletter. It is available from RAF at $18.50 ($20.50 overseas). Maybe we can get Jim to also show construction details on that pretty 2-piece canopy. **PHOTOS OMITTED**

Charles Allen (s/n 27)
Charles moved the main gear retraction motor assembly forward 5 inches to provide better cable access (as suggested in newsletter No. 7). He built a new bulkhead in front of F152 and tied it into the WR12 ribs with gussets. The photo shows the installation of the motor gears and extra pulleys. He plans to provide turnbuckle access through an inspection door on the bottom skin. He used Boston chain on the nose gear and used the NG1 spool as an idler to adjust cable slack. **PHOTO OMITTED**

Jack Rosen (s/n 402)
Jack has eliminated the gears on the nose gear system by a two-stage #25 Boston chain drive. The upper sprocket mounts on the AN5 bolt through the belcrank bearing shown on the plans. The upper and center axles mount to a reinforcing plate on F31 that consists of 1/4 inch ply and 1/8 inch aluminum. The 5/16 inch belcrank bearing on the center pivot is adjustable to adjust both chains. Boston sprocket numbers are shown on the photo. **PHOTO OMITTED**

Harold Reiss' instrument panel layout. **PHOTO OMITTED**

Metal parts from Bill Campbell (see shopping) **PHOTO OMITTED**

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Design ultimate load on VECS 3 and attachment.

The static load produced no failure, so we tried a dynamic test load. VECS3 shows no indication of loosening after 5 or 6 good bashes, so we tried wrenching it out with pliers, and failed CS3 first.

Static load testing the winglet to wing joint.

Phil Testa receiving the first set of EZE plans on June 26.

Phil Testa's EZE project in early September!

T. Bailey, (EZ S/N 138) constructed the handy roll-around unit for building his EZ shown in the photo. Note the handy storage and valves for easy dispensing and the electric drill for mixing.

What'a ya mean, your EZE is shinier than mine?

Static loading a production gear leg.

Oshkosh workshop. Sometimes it was hard to get your questions answered.

3:40-3:00-5 tire mounted on the Cleveland 5" wheel.

Comparing the 4:10-3:50-5 and 3:40-3:00-5.

This bizarre contraption is the roving impregnating machine designed and built by Fred Jiran for VariEze landing gear production.

No Martian. One of Fred's troops cleaning up a main gear leg before delivery.

The following information has been distributed to all FAA offices responsible for homebuilt inspections and to those foreign inspecting authorities requesting it:

AMATEUR-BUILT VARIEZE INSPECTION CRITERIA

1.0 Scope
This document has been prepared to assist inspection personnel by providing recommended acceptance criteria and acceptable repair practices for the VariEze amateur-built composite sandwich structure.

2.0 Background Information

2.1 Design Criteria
The materials, methods, and practices employed by the amateur builder in the construction of the VariEze type are new to light aircraft construction and may be unfamiliar to the inspection personnel involved with the licensing of amateur-built aircraft. Structural design criteria for the VariEze exceed F.A.R. part 23 requirements. In-house component testing of the primary flight structure has been conducted to 200% of design limits. Detail documentation of test data is on file at Rutan Aircraft Factory. The aircraft is considered to be a utility category aircraft. VariEze builders are being supplied with a complete owner's manual which specifies all placards, operating limitations, normal & emergency operations, flying qualities, maintenance specifications, inspection procedures, & initial flight test procedures.

2.2 Structural Approach
The basic structure throughout the design is a composite sandwich of load bearing fiberglass skins separated by a light-weight foam core. While the materials and processes are tailored

to the amateur builder, the structural layout is very similar to the honeycomb composite structures utilized in military and transport type aircraft and fiberglass sailplanes. Loads are carried by Epoxy/"E"-type fiberglass lamina. Foams of various types and densities are employed as a form (upon which the load bearing material is shaped) and as local buckling support. In no instance are foams used to transmit primary loads, as is the case in some other amateur-built designs.

2.3 Inspection Techniques

The transparent nature of the fiberglass/epoxy material allows for visual inspection of primary structure from the outside prior to finishing. Defects in the structure, as described in paragraph 3.0, are readily visible even in the deepest laminate.

2.4 Inspection Sequencing

The external visual inspection capability provided by the materials allow inspection of all primary structures at any point before finishing. All primary structures are at the surface, eliminating the requirement for "pre-cover" or "closure" inspections. Opaque filler materials are used throughout the airplane in finishing. and inspection must take place before any areas are obscured. Some areas may have opaque materials applied to one surface where the structure is inspectable from the opposite side (wing trailing edge for example).

3.0 Defects

3.1 Voids

Interlaminar voids in a new layup may be due to small air bubbles trapped between plies during the layup. These void areas look white and are distinctly visible even deep in a cured layup. Interlaminary voids up to 1 inch in diameter do not require repair, as long as they do not consist of more than 5% of the surface area.

Interlaminar voids (air bubbles) up to 2 inches in diameter are acceptable when repaired as follows: A small hole is drilled into the void and epoxy is injected into the void area. Small voids such as this may occupy up to 5% of the laminate surface area.

Voids greater than 2 inches in diameter should be repaired as shown in paragraph 4.

3.2 Lean Areas

Areas where the epoxy/glass matrix is incomplete because of inadequate wetting of the cloth with epoxy (lean areas) are speckled whitish in appearance. The fully wetted laminate will have a consistent transparent greenish appearance. Epoxy lean areas are acceptable, as long as the white speckled area is less than 10% of the

surface area. White-to-green ratios greater than 10% require rejection or repair as shown in paragraph 4.

3.3 Rich Areas
Resin richness primarily adds weight to the laminate. While some degradation of physical properties does occur, a overly wet (rich) layup is not grounds for rejection.

3.4 Inclusions
Bristle paint brushes are used throughout the layup process. As a brush begins to deteriorate it will shed some bristles into the laminate. The bristle inclusions, up to 20 bristles per square foot, are not cause for rejection. Occasional inclusion of small woodchips or other small foreign objects is not grounds for rejection.

3.5 Fiber disruption
In all instances, it is good practice to have the glass fibers lying flat and without wrinkles. Major wrinkles or bumps along more than 2 inches of chord are cause for rejection in the wings, canard, and winglets, particularly on the upper surfaces (compression side). Disruptions greater than 2 inches require repairs per paragraph 4.
SKETCHES OMITTED

3.6 Finishing Damage
Damage to the external structure by sanding in preparation for surface fill and paint can occur. Occasional sanding through the weave of the first skin ply is not grounds for rejection. Sanding through areas greater than 2 inches in diameter completely through the first ply or any damage to interior plies must be repaired in accordance with paragraph 4. A damp rag passed over the sanded surface will make the plies show up to determine how many plies have been sanded away.

3.7 Service Damage
Damage to the glass structure will be evidenced by cracked paint, or "brooming" of glass fibers. Both of these indicators are clearly visible. If either type of indication is present the paint and filler should be sanded away, bare laminate inspected, and repairs made per paragraph 4 as required. Where surface damage has occurred it is also likely that local foam crushing has been inflicted.

3.8 Delaminations
Delamination of glass/epoxy lap joints is evidenced by physical separation of plies. These defects are easily visible and easily repaired. The leading and trailing edges of flying surfaces (wing, canard, winglets) should be free of delaminations.

3.9 Multiple Defects
Where multiple types of small defects occur

in a laminate (voids, fiber dislocations, and lean areas for example). They should not exceed a total of 10% of the surface area of the laminate, or 20% of the wing chord at any one spanwise position.

4.0 Repairs

There are seldom single defects so massive that a major component must be scrapped. The repair procedures described here may be applied throughout the VariEze and VariViggen SP composite sandwich structures.

4.1 Small Void Repairs

Voids up to 2 inches in diameter may be repaired by drilling a small hole into the void and injecting the void full of epoxy. A vent hole opposite the injection point is required to allow air to escape.

4.2 Large Defects

Excessively large voids, lean areas, finishing damage, fiber disruptions, major fiber wrinkles, or service damage may be repaired using this procedure. Remove the rejected or damaged area by sanding or grinding and taper the glass laminate on a slope of approximately 2 1/2 cm per ply in all directions. The plies are visible as the sanding is done. The tapered glass edges and surrounding two inches of glass surface must be sanded completely dull. Damaged underlying foam should be removed and the void filled with a dry microsphere/epoxy mixture or a replacement foam piece. The damaged area is then laminated over using the same type and orientation of glass plies removed, each ply lapping onto the undamaged glass at least one inch. The whole repair area is covered with an additional bidirectional glass ply. **SKETCHES OMITTED**

4.3 Delaminations

A delaminated joint should be spread, the mating surfaces sanded dull, gap filled with flox (epoxy/flocked cotton mixture), then clamped shut while it cures.

5.0 Materials

Since a wide range of similar appearing materials exists which exhibit substantial differences in physical (structural) properties, Rutan Aircraft Factory has established a distribution system to provide the amateur builder with proven acceptable materials. RAF strongly discourages the substitution of materials. Homebuilder substitutions for the basic structural materials constitutes major structural modification to the VariEze design, and could adversely effect flight safety.

6.0 Applicability

These acceptance criteria are different from and, in some cases, much looser than for similar structures found in sailplanes and other contemporary composite structures. These criteria apply only

to the VariEze and VariViggen structures.
Design safety factors in excess of three enable
somewhat relaxed acceptability criteria compared
to other similar structures.

CP10, Page 14

BELOW IS VARIEZE SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIEZE TWO-PLACE SPORTPLANE

**PHOTOS OMITTED

THE STORY
For the last 12 months, we have refrained from promotional activities and marketing on the VariEze to concentrate totally on its development and setting up materials and components distribution. In this short time, we have 1. flown a full 350 flight-hour test program on two prototypes, one Continental and one VW-powered, 2. completed full structural qualification testing, 3. prepared a manual for the amateur builder to educate him in the structural materials and to guide him through construction, 4. set up a materials distribution system through established, competent distributors.

THE TEST PROGRAM
The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE RESULTS
The VariEze has superb flying qualities for its primary mission - comfortable travel. It has excellent hands-off stability even in turbulence. It is unusually safe at low speeds, can be flown with full aft stick (47 kt) without being susceptible to departure or spin, regardless of attitude or power. Performance is also superb - cruise up to 200 mph and climb up to 1700 fpm at gross weight with the larger engines.

THE MISSION: PRACTICAL UTILITY
Although quite compact outside, the VariEze provides unusual comfort for up to 6-ft, 7-in, 210-lb pilots and 6-ft, 5-in, 220-lb passengers, plus two medium-size suitcases and four small baggage areas. The 24-gallon fuel load allows up to 1000-mile range at economy cruise. High altitude climb is excellent, for flying over turbulence, mountain ranges, and for satisfactory high-density altitude take offs.

THE DESIGN
The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic systems design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE STRUCTURE
New composite sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, longer life, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair.

THE HOMEBUILDER SUPPORT
The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations. Construction seminars are provided at RAF and elsewhere.

THE AVAILABLE HOMEBUILT
Established, competent distributors have stocked materials and components before the aircraft was marketed. All raw materials are now available plus many prefabricated items including canopy, landing gear, wing quick-disconnect fittings, cowling, all machined items, rudder pedals, engine mounts, suitcases and upholstery. If you choose to purchase all prefab parts, you can build your VariEze in about 500 man-hours - really!

VariEze documentation is available in five sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full-size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words! The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, A75, C85, C90, 0-200
SECTION IIB - VW engines (avail. Oct '76)

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system, avionics, landing and position lights, antennas, starter. Avail Sept. 76

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim. Avail Sept 76

Specs & performance with 100-hp Continental.fixed-pitch prop.@ gross weight

Take Off	800 ft
Climb	1700 fpm
Max Cruise	200 mph
Econ Cruise	165 mph
Range @ Max Cruise	720 mi
Range @ Econ Cruise	980 mi
Min Speed (full aft stick)	49 kt
Landing	900 ft
Canard Span/Area	12.5'/13 square feet
Wing Span/Area	22.2'/53.6 square feet
Empty Weight	520 lb
Gross Weight	1050 lb

Specs & performance with 75-hp Continental

Take Off	950 ft
Climb	950 fpm
Max Cruise	178 mph
Econ Cruise	145 mph
Empty Weight	490 lb
Gross Weight	950 lb

Check items desired:	Price, including First class mail U S and Canada	Air mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher' newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$94.00	$108.00
Section IIA or	$19.00	$21.00
Section IIB		
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00

Calif. residence add 6% tax on all items except newsletter

* U.S. funds only

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft stick	49 mph
	Landing	500 ft
Performance with 150-hp. Special Performance Wings	Climb	1000 fpm
	Cruise	158 mph
Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 square feet
	Wing Span/Area	19 ft/119 square feet
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications Special Performance Wing	Wing Span/Area	23.7 ft/125 square feet
	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price: $4.75 per year first class mail, $6.50 air mail overseas. Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing, 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described. Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles. Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price: $4.75 first class mail, $5.50 air mail overseas.

The following are RAF-authorized distributors of materials and components. Items indicated have been developed under RAF approval and are recommended for VariViggen or VariEze aircraft. Contact the distributors at the address shown for his catalog and description of items. Indicate to him that you are a VariViggen or VariEze builder.

AIRCRAFT SPRUCE & SPECIALTY CO. WICKS AIRCRAFT SUPPLY

201 W. Truslow Ave.
Box 424
Fullerton, Ca. 92632
(714) 870-7551

OR

1100 5th Street
Highland, Il. 62249
(618) 654-2191

Catalog cost $2 - Refundable at first order.
VariEze materials: epoxies, foams, fiberglass, filler materials, wood, metals, all hardware, specialized tools, skin barrier cream, seat belt/shoulder harness sets, wheels & brakes & custom upholstery/suitcases.
VariViggen materials: spruce kit, plywood kit, hardware, aluminum & fiberglass.

KEN BROCK MANUFACTURING
11852 Western Ave.
Stanton, Ca. 96080
(714) 898-4366

Catalog cost $1 - Refundable at first purchase.

VariEze prefabricated components: wing attach/quick disconnect assemblies, nose gear machined parts, control system components, fuel cap assemblies, welded engine mounts, welded stick assembly, welded rudder pedals, wheels & brakes.
VariViggen prefabricated components: all machined parts.

FRED JIRAN GLIDER REPAIR Write for brochure.
Building 6, Mojave Airport
Mojave, Ca. 93501
(805) 824-4558
VariEze prefabricated components: Molded S-glass main gear and nose gear struts, nose gear strut cover, nose gear box.

COWLEY ENTERPRISES Write for brochure.
P.O. Box 14
Santa Paula, Ca. 93060
(805) 525-5829
VariEze plexiglass canopy - Light bronze tint or clear.

H. C. COMMUNICATIONS Write for brochure.
Box 2047
Canoga Park, Ca. 91306
VariEze and VariViggen custom COM & NAV VHF antennas.

MONNETT EXPERIMENTAL AIRCRAFT, INC. Ask about VariViggen parts.
955 Grace St.
Elgin, Il. 60120
(312) 741-2223
VariEze - None
VariViggen - All molded fiberglass parts

GOUGEON BROTHERS Write for brochure.
706 Martin St.
Bay City, Mi. 48706
VariEze - None
VariViggen - 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS Contact him for list
4102 Twining
Riverside, Ca. 92509

VariEze - None
VariViggen - welded nose and main landing gear, 1-1/4" sq. steel tube.

BILL CAMPBELL (VariViggen builder) Contact him for list.
Box 253
Phelan, Ca. 92371
VariEze - None
VariViggen - Prefab brackets and fittings.

JESSE WRIGHT Contact him for list.
7221 S. Colorado Ct.
Littleton, Co. 80122
VariEze - none
VariViggen - prefab wood parts.

THE CANARD PUSHER No 11 Jan 77

NEWS OF THE VARIVIGGEN AND VARIEZE PROGRAMS
(very vig-in) (very easy)

NEWSLETTER SUBSCRIPTION - $4.75/yr
OVERSEAS SUBSCRIPTION - $6.50/yr
BACK ISSUES - $1.00 each

PUBLISHED QUARTERLY BY
JAN, APL, JLY, OCT

RUTAN AIRCRAFT FACTORY
Bldg. 13, Mojave Airport
PO Box 656, Mojave, Ca. 93501
(805) 824-2645

RAF ACTIVITY Since October has been concentrated in several areas. All remaining sections of the VariEze plans were completed and backorders filled. We brought N4EZ (0-200-powered VariEze) into the shop for the first time since it was built and made some modifications. The plan's-configuration, manual nosegear system was installed (it had earlier been tested on N7EZ), the stiffer main gear was installed, a new fuel system incorporated, a landing airbrake fitted, and Cleveland main wheels were installed. All those modifications have been flight tested with very satisfactory results. The landing brake makes the airplane easier to land and makes short runways more acceptable. We found that we had been using an incorrect combination of Gerdes brake cylinders and Rosenhan brakes. Rosenhan brakes have a smaller cylinder and must be used with Rosenhan master cylinders (1/2-inch cylinder dia.) for good brake effectiveness. The original main landing gear strut on N4EZ was a wider tread and was more flexible, which allowed the airplane to ride quite low with reduced wingtip clearance. The strut was redesigned back in May before drop tests and before Jiran produced the homebuilt gears. The new gear, now installed on N4EZ, raises the airplane about four inches in the back, improving wingtip clearance without compromising taxi handling.

Recent flight tests with N4EZ have included more stall tests to evaluate any effects due to the landing brake, and ?????? to several small airports to evaluate runway requirements.

There were several things about the VariEze fuel system we were not completely satisfied with: first, the need for a pump to backup the normal operation of the header tank; second, the possibility of foaming the fuel in the vibrating header tank mounted on the engine; and third, the inaccurate indication of the last few usable gallons of fuel. The new system, which is detailed in this newsletter, solves all these problems and increases effective fuel head to the carburetor, since the header tank is removed. The only disadvantage of the new system is that Burt Rutan is now stuck with several hundred header tanks and fuel valves.

Some of our time has also been spent on further design work of the NASA AD-1, a small, all composite (foam and glass) research aircraft, using the skewed-wing concept. The AD-1 is a 15%-size manned, flying model of a Boeing-designed transonic airliner.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

New landing airbrake on N4EZ

Cleveland Brake Installation on N4EZ - It probably would be a good idea to rotate the brake up a little higher than this to allow clearance with a flat tire.

The VariEze construction seminars have been very successful. Since October we have conducted ten seminars around the world with over 2000 people attending! Hopefully those 2000 will share their experiences with others and the need for long-distance education will begin to taper off. We plan to conduct only four additional seminars, the dates and contacts follow. If you are building or going to build a VariEze, be sure to attend one.

February 5		Snohomish, Washington
	Contact:	G. Carter Miller 4912 Senic Terrace Yakima, Wa. 98908
February 18 and 19		Denver, Colorado
	Contact:	Bill Cassidy 4652 Montview Blvd. Denver, Co. 80207
March 27		Anderson, Indiana
	Contact:	Mike Melvill P.O. Box 561 Frankton, In. 46044
April 2		St. Paul, Minnesota
	Contact:	George B. Wilson 2924 108th Lane NW Coon Rapids, Mn 55433

Please contact the people organizing each seminar a week or two in advance of the seminar date. Be sure to include a self-addressed, stamped envelope. They will send you a flyer describing the seminar. The seminars held this fall had two to three times as many people attend, as had contacted the organizers! The more the better but it helps to know that you're coming!

N27VV, the VariViggen prototype, has done a little local flying and attended the Chapter 49 Fly-In breakfast but that is all. N7EZ is still dormant but will be prepared for some serious distance record attempts. Its distance capability in class C-1A is about 3300 miles.

Every day we get a few calls asking if any homebuilders are flying yet. The answer is no, not yet, but soon. The Wicks Organ Company airplane, the Cowley's airplane, and half-a-dozen other builders may fly before this newsletter reaches you. It looks like Oshkosh 77 may be a big year for the VariEze. The coming two or three months should see the first flights of a couple of VariViggens as well.

NEWSLETTER BACK ISSUES

Canard Pushers from 1 to 82

For those of your who are new readers of the "Canard Pusher" and wonder what has transpired in the past, there are now a grand total of eleven issues in print. The first six are concerned with the VariViggen exclusively. Issues seven through eleven contain VariEze and VariViggen information. If you are going to build a VariViggen you will need all eleven issues to update your plans. If you are a VariEze builder you need this issue (#11) and the October 1976 issue (#10) for plans update. If you have very recently purchased plans (after February 1, 1977) a yellow sheet of changes may be bound into your manufacturing manual. If you have the yellow change sheet included, you only need newsletter #11 and on, to keep your plans current. If you sell your plans to someone else, please pass this information along with the plans.

FOREIGN BUILDERS

A package of VariEze engineering documentation has been mailed to the regulating governmental agencies of the countries listed below as an aid to homebuilders seeking permission to build. If your country is not listed and documentation is required to obtain permission to build the VariEze, have the cognizant office in your equivalent to our F.A.A. contact us on their stationery requesting a copy. Documentation has already been sent to the following nations.

Australia
Canada
Republic of South Africa
West Germany (BRD)
Belgium
Great Britain
Iceland
France

VARIEZE LANDING BRAKE SUCCESSFUL

A drag device has been developed on N4EZ to improve its previously poor short-field performance. The landing drag device was developed because the VariEze had to be approached at a low flight-path angle and used excessive runway in the flare due to its slow deceleration.

The landing brake is not a speed brake for high speed deceleration. It automatically closes above ninty-five knots to prevent overstress. As you can see in the photo, it is a very large belly-board positioned to avoid any pitch trim change. It hinges at a position just aft of the front seat bulkhead. A spring snubs it up in the closed position and provides sufficient down load in the open position that the pilot can deploy the brake with only a ten-pound force on the handle. The landing brake handle is located on the left console. The handle is immediately aft of the throttle with the speed brake closed and moves up and aft to open. In the open position the handle interferes with the pilot's arm enough to remind him that it's down, so he doesn't forget it for takeoff. Climb performance is adequate with it down, but engine cooling would suffer. There are no locks on the handle. The pilot merely moves the handle and the brake remains in the selected position (open or closed).

Now for the good news. The landing brake makes a dramatic improvement in the airplanes landing performance. Approach angles as high as seven and one-half degrees are possible with the engine at idle (about like a

Cessna 150 with one-half flaps). Forward visibility is improved because the approach can be flown faster (eighty to eighty-five knots) without severely compromising landing distance. Speed bleed-off in the flare is relatively rapid, similar to most lightplanes. Touch down scatter is considerably less than without the brake. Thus, it is much easier to "put it down on the numbers." VariEzes were previously restricted to runways greater than 2400 feet. The landing brake allows a pilot with appropriate proficiency to routinely use airports with runways less than 1800 feet.

The speed brake results in a mild buffet, similar to that with full flaps in some other lightplanes. There is no pitch, roll, or yaw trim due to brake deployment. Other than the noticeable buffet, the stall characteristics are not changed. The airplane is easier to fly the approach and to land with the speed brake deployed.

While the brake does improve the short field performance we still strongly recommend that you adhere to the field length restrictions in the owner's manual for your initial testing.

We are planning to prepare drawings for the speed brake and should have them completed before newsletter twelve. If you want to install a landing brake in your VariEze do not change anything in Section I. The brake is just as easy to install as a retrofit, as it is during initial construction. Please do not ask for the drawings before newsletter twelve; they will be available at that time.

VARIEZE PROPELLER EXTENSIONS
Now that Section IIA is out, we have received a number of requests for a recommended source of prop extensions. Suitable extensions are available from Ken Brock Manufacturing, Ted's Custom Props (9917 Airport Way, Snohomish, Wa. 98290), and Bill Cassidy (4652 Montview Blvd., Denver, Co. 80207). Contact them for details.

We mentioned earlier that we had used the standard Cessna 150 extension. We understand that Cessna has a newer extension out now and that it isn't suitable for a wooden prop. A wooden prop must be very accurately centered using a centering hole in the prop which mates with a centering boss on the extension or engine drive flange. The drive lugs and mounting bolts are not suitable for centering the prop. The newer Cessna extensions may also be short on surface area against the prop hub for use with wood props. We modified the older Cessna extension by adding a centering boss to it. If you have any questions about using an extension, call your prop manufacturer for his opinion.

The insert that we used to adapt the older solid type of Cessna extension looks like this: **SKETCHES OMITTED**

This adaption is for a flanged crankshaft. Anyone using a tapered shaft (S.A.E.O) should specify this when ordering an extension, since these engines require a different part.

VARIEZE ENGINES
The Continental 0-200A installed in N4EZ has 200 hours on it now and the crankshaft end-play measures exactly what it did on installation (.0105). We continue to believe that there will be no problem with the

A-model engine installed on the VariEze. The total maintenance to date on the 0-200 has been an oil change each fifty hours.

Two engines under consideration for an eventual Section IIC are being installed in VariEze airframes now. One builder is working on a stripped Lycoming 0-235 installation and another group has a Honda Civic installation ready for initial testing. No data is yet available on the success of either installation but we are hopeful of good results from one or both within the year. Let's hope that both of these groups have the resources to pursue their projects to a successful completion, but please don't bug us with requests for advance information on their progress!

We understand that the Revmaster folks are continuing their development work on a good VW installation for the VariEze but we haven't heard from them lately.

VARIEZE CONSTRUCTION HINTS

Every time we turn around it seems like we discover a little better, faster, or easier way to build a VariEze. The hints in this section are a collection from our seminars and from the inputs you builders have made. Some of the information is new and some is clarification of items people seem to have trouble with.

Basic Glass Working Techniques

Paint Roller - Tracy Saylor has suggested using a thin paint roller, cut to a three inch width to help wet out the cloth. We've been using one and are pleased with the results. Do not dip the roller in epoxy; use your brush to apply epoxy to the general area where required, then use the roller to wet out the cloth and distribute the epoxy evenly over the surface. The three-inch roller width is great for working down in the canard spar trough and other tight spots. Rollers can be cleaned in acetone or M.E.K. a time or two before you throw them away.

Bristle Stipple Roller - The giant pipe cleaner supplied by Aircraft Spruce and Wicks is a stipple roller. Those of you who haven't figured out how to use it on your own can look at the cartoon "wetin' it out" on page 3-17 and on page 18-2 in the photos. You build your own handle from some aluminum or steel sheet scraps.

Dry Lay-Ups - The finished parts that we have seen at seminars have generally been very good. The general tendency, however, has been to make parts a little dry. You guys are taking our emphasis on stippling and "not wet" a bit too zealously. Be sure your lay-ups are not too dry (with small white flecks of unwetted glass visible). When you think you are finished with a lay up, DON'T QUIT. Take your portable light and very carefully inspect the lay-up while it's still wet. A cured lay-up that is too dry must be rejected. Also, before you leave a lay-up to let it cure, get a second opinion. Have the wife come out and inspect it while it's still wet and fixable.

The structural quality control criteria in section I, section V, and newsletter 10 are maximum allowable defects. Anything worse and the

part must be repaired or rejected. Your structural parts in general should be much better than these criteria.

Do not assume that the plans do all your thinking for you. Check all sections, photos, drawings, etc., on each step. Be sure you have no bumps, depressions, or joggles on the surfaces in a spanwise direction on all structural parts.

We have been informed of two instances where epoxy has been found to be too viscous - one or two bottles in a given shipment being more viscous than the others. If your epoxy is thick like honey, return it to the distributor for replacement. Also, if any separation occurs in your hardener, shake well and warm the bottle (80 degrees); if any settling still occurs, return the hardener for replacement.

Lighting - We've found that the source of many problems has been poor lighting in the shop area. If you can't see well you can't do good work. A lot of generally well done parts have bubbles, dry areas, or wrinkles just because the builder didn't have good enough light to see them!

Flox Corners - Paint a light coat of pure epoxy inside before troweling in the flox. This improves the bond of the flox with the dry glass.

Slurry - Don't be skimpy with the micro slurry over foam before you lay up glass. An incompletely slurried foam surface will allow little pockets of air to remain between the first ply of glass and the foam. The porous glass/foam interface can result in a premature breakdown of the foam-to-glass bond, and reduced surface durability. This is particularly important with urethane foam.

Micro Fills - If you fill a foam ding or nail hole with dry micro before laying glass over the surface, the micro will be soft during the lay-up and hard stippling will push the dry micro out of position. Avoid stippling ambitiously directly over a fresh micro fill with your brush. The paint roller is useful in these areas because it will bridge across the fill area and help wet the cloth without disturbing the micro.

Shop Temperature - In Section I we gave a maximum temperature range for glass laminating of sixty-five to ninty-five degrees Fahrenheit. The desirable shop temperature is about seventy-five degrees Fahrenheit. It's winter and a lot of you are trying to work at the minimum temperature of sixty-five degrees Fahrenheit. A major lay-up done at sixty-five degrees can take nearly twice as long to do as it does at seventy-five degrees Fahrenheit, because of the additional stippling time required to wet out the cloth.

"Peel Ply" - The bulk of sanding on cured glass surfaces in preparation for glass-to-glass bonding can be avoided by using a "peel" ply. A peel ply is a layer of dacron fabric which is laminated into a lay-up as though it were simply an extra ply of glass. The peel coat wets out with epoxy just like the glass cloth does and cures along with the rest of the lay-up. The dacron peel ply doesn't adhere structurally to the glass and can be peeled away from the cured glass very easily (about like masking tape). The removal of the peel ply leaves a surface which is ready for glass-to-glass bonding without sanding. Here's an example

of how to use the peel ply: in Chapter eight, Step six, lay up the top side pads, sparcap, and shear web just as the instructions on page 8-6 describe, then laminate one ply of dacron cloth over the front and back faces (shear web) of the spar. Let the assembly cure. When you are ready to lay up the bottom side, simply peel the dacron ply off on the fore and aft faces, leaving a surface which is ready for bonding. The peel ply is never left in the finished part; it is always removed as preparation for the next lay-up.

The peel ply can be used handily on the canard shear-web, leading and trailing edge glass lap joints of all aerofoil surfaces, wing shear web, center section spar, and wing tip/winglet root skins. The material for use as peel ply is 2.7 ounce/yard dacron polyester fabric. Both Wicks and Aircraft Spruce have the material or you may find Stits Polyfiber D-103 available at your local aircraft recovering shop. The dacron material is available in yardage and in conveniently-sized tapes.

Foam Core Assembly

Joining Foam Blocks - First paint a thin coat of epoxy (no micro) on the joining foam surfaces. Second, trowel a wedge of dry micro on the center of one surface. Third, squeeze the joining surfaces together, wiggling them back and forth, to obtain a thin micro joint less than one-sixteenth-inch thick. It is desirable to have the micro low in the joint about three-eights to one-half inch (not to get squeeze-out). The low joint is filled with micro before glass is laid over the joint, allowing a wet bond between the micro and the glass. You will occasionally get some squeeze-out even trying not to, so just wipe the joint low with a mixing stick. Do not try to fill large voids with micro; you are taking a chance of getting exotherm damage. If you have a void larger than about 0.1 inch, fill it with a sliver of foam with micro on each side, rather than solid micro.

Alignment - If your foam core is cockeyed when you glass it, your airplane will be cockeyed too and probably fly that way. Get your foam cores assembled correctly. Use lots of nails to hold it straight while the micro cures. Check the depth of the spar notch and be sure that it's correct, top and bottom. Wing and canard foam cores should be assembled vertically as shown in the photos on page 6-6, nailed together firmly, and the depth of both spar notches checked before placing it in the jig blocks.

Weight - Micro is heavy and costs a lot more than foam scraps. Use a foam block to fill the big gap around the wing fitting nuts instead of the large micro fill shown on page 6-18 (inside the wing root). Even a rough fitting foam block will be much lighter. The interior foam face is given a one-ply BID protective covering.

General Hints/Clarifications Page 6-5 - The seventh ply of BID, fifty-three inches by twelve inches, is used for the wing root and mid spar ribs shown on the top of page 6-6, same step.

Wing Jig Blocks - Jig block "F" may need to be shimmed slightly to get the leading and trailing edges straight. Jig block "E" must be notched slightly to allow the wing fitting to nest properly.

Wings - Above all else, both wings must have the same twist and be set at the same incidence.

Brakes - Use Rosenhan master cylinders with Rosenhan brakes. The Gerdes or Rosenhan master cylinders can be used with Cleveland brakes. Do not match Cleveland or Gerdes master cylinders with Rosenhan brakes.

--Ed Hamlin reports that a Dremel #428 wire brush works beautifully for cleaning the residual foam and micro off of the canard, wing and winglet trailing edge overlaps in preparation for the top skin lay-ups.

--Builders wishing to use enamel or acrylic enamels may want to use Dupont 3011S enamel primer surfacer in place of the 70S lacquer primer surfacer. 3011S provides the same ultra violet barrier that 70S does (see section V).

--Be sure you have at least the overlap shown at the trailing edge for the top and bottom skins (0.4 inch on canard; 0.5 inch on wing and winglet). Be sure the overlap area is sanded well before top skin layup.

--Do not pressure-check the fuel tanks before installation of the outside skin, unless a low pressure (five hundred feet) is used. (Page 21-6).

--Elevons must be free of friction.

--Use a lubricant on the mating surfaces of the wing fittings and NG13 guides (Lubriplate, Molycoat or eq.).

--When mounting NG6 and NG15 to NG1, layup a two-ply BID patch between NG1 and the castings. Mount wet, with flox filling any voids.

--One builder moved his canopy forward two inches from the position shown on the plans to obtain more room for the pilot to lean forward in flight. (This is being done on Jirans prefab canopy frames.

--The NG6 casting supplied by Ken Brock is narrower than is shown on page 17-3, a change dictated by production tooling. Nothing is changed because of this; Brock is simply including two spacers to center NG6 in the airplane. NG7 should be 2.75 inches long.

--Don't be concerned if you find it necessary to grind some of the MG-1 landing gear leg away to set the proper toe-in. A little grinding is normal and up to one-fourth inch of the gear leg thickness can be removed without structural concern. The mains should have about one degree toe-in.

--The basic bill of materials doesn't include the eight AN4-15A bolts and MS21042-4 nuts required for installation of the Cleveland axles. We have now flown Cleveland brakes and are happy to confirm that they provide excellent braking effectiveness.

--The sketch at the top of page 18-2 has confused some builders. The seventeen-inch dimension is correct, and the gear leg sweeps forward as the three-view drawing on the back cover shows.

Hot Wire Controls - The simple wire-and-nails voltage control shown in newsletter #10 can be hazardous if improperly used. Do not use it if the floor is damp. And, be sure you have the correct end to ground. Careless operation could ruin your whole day!

The schematic shown below is another possibility for a good hot wire control. This one cannot shock you. **SKETCH OMITTED**

URETHANE FOAM DETERIORATION

Newsletter #10 reported on the urethane deterioration in the fuselage side on N4EZ and its repair. Since then airplane has had some rugged use including large temperature cycles. Recent inspection revealed that there has been no further deterioration. The repair is sound and there appears to be no cause for concern in this area.

N4EZ has had some urethane foam damage in another area. This is in the center of the fuselage floor from F.S. 80 to F.S. 95. As shown in the sketch this occurs only in the center where the floor surface is convex and where high concentrated loads are applied when a heavy backseater with hard soled shoes puts all his weight in one local area. The glass skin is not damaged but the foam is locally deteriorated under the glass. This was repaired by gluing a piece of nine-millimeter, six-pound PVC (red) foam on top with wet micro. The PVC is heat formed (three hundred degree oven or heat gun) to hold its shape and weighted in place. After cure, layup two plies BID over the PVC. This provides a very durable surface. The PVC piece is fifteen inches long and ten inches wide. It is recommended that you install this piece in your airplane to prevent damage. It is not required over the entire floor. The concave surfaces spread the load out and no damage occurs. If you have no six-pound PVC you can substitute balsa wood. **SKETCHES OMITTED**

VARIEZES HAVE MODERN CABIN HEAT SYSTEM

Those of you northern die-hards that still think the VariEze needs an exhaust-powered cabin heat system should go to the library and look up a book on solar heating systems. You will find that the VariEze fuselage is strikingly similar to a well-designed solar heat collecter--a urethane foam box, diffused surfaces inside, glazed on top with plexiglass. It is well ventilated for summer cooling but with the vent closed and a good canopy seal you can maintain seventy degrees Fahrenheit inside temperature, with an outside air temperature of ten degrees Fahrenheit! This heating system, of course, does not work at night, but good fighter pilots fly in the daytime and love at night.

QUESTIONS/ANSWERS

We continue to be asked questions about our opinion of systems or configurations different from those who have tested and recommend on the Viggen or Eze. Please remember that if we haven't built or tested a given aerodynamic configuration, engine installation, avionics system, etc., our answer must be that we "don't know." We will continue to support builders by helping them with any problems or

questions they have, relative to the basic airplane and systems as shown on our plans, but we cannot serve as a clearing house or consulting service for items different from those in which we are familiar, particularly different engine systems and avionics.

Remember, your letters can be promptly answered only if you provide a self-addressed, stamped envelope. If the S.A.S.E. is not included, we will answer your question in the next newsletter.

Q. I want to keep my VariEze as simple as possible and plan to eliminate the roll and yaw trim. Is ground-adjustable trim okay?
A. We appreciate your desire to keep it simple, but do not eliminate inflight trim. The VariEze is a real pleasure fly in-trim or hands-off (which requires three-axis trim) but is quite a nuisance when out of trim, particularly in roll. We consider the ability to adjust roll trim with major power changes a mandatory item.

Q. I haven't been able to get to one of the demos--when can I see the VariEze?
A. We have not been showing it on an individual basis since this requires locking up, traveling a mile and opening the T-hangar. The response has been so great that this would take all our time. This situation will be resolved by about the end of February since we will be moving into a hangar on the flight line so you can come in anytime and inspect the airplane.

Q. I don't want to build an airplane that is still undergoing changes. When are you going to freeze the design and stop making changes?
A. We are more interested in the research and development aspects of aircraft than in marketing/promotion. Trying different things to improve an airplane is where our expertise lies. We expect to continue to use the VariEze as a research test bed for a long time, experimenting with several interesting concepts and may be making changes ten years from now.

Q. I'm just about ready to make the first flight in my VariEze. What words of wisdom do you have to the "about to be" test pilot?
A. The best thing we can tell you is to read your owners manual very carefully and follow exactly all the information and limitations shown. The VariEze is a very stable airplane but has lower stick forces than the average lightplane. So, get some time in a Yankee or other "sensitive" airplane. Also, remember that your rudders are a more powerful roll control than the elevons, and if your new airplane is crooked you may need rudder to keep things upright. In fact, you should fly the airplane primarily with rudder, since if there is anything that takes getting used to on the VariEze it is the tendency to input pitch when trying to use only aileron. So, if you use the stick only for pitch and the rudder to turn, things will seem easier, particularly if your proficiency is not good. Also, remember to keep the airplane in trim by adjusting pitch, roll and yaw trim. When in trim the airplane will hold speed and level flight even in turbulence without pilot effort. This will make your initial flights much more comfortable than fighting an out-of-trim condition. On final approach,

set up roll and yaw trim for coordinated level flight, then the rest of the landing is VariEze indeed.

Too many people do a professional job of building their airplane then lose everything because they do a non-professional job of flight testing. If something is not quite right--fix it before you fly. Be sure your pilot proficiency is sharp and current.

IMPROVED VARIEZE FUEL SYSTEM

We have recently tested a new fuel system in N4EZ that offers some significant advantages over that currently shown in Section IIA of the plans. The following schematic shows the system. Note that the pump and the small header tank on the vacuum pump pad are both eliminated. **SKETCH OMITTED**

The fuselage tank is filled when the aircraft is fueled-- it has its own cap (same cap as on wings). The fuel system is operated as follows: The fuselage tank is normally used only for starting the engine with the nose down. The wings are selected after the nose is up and the pilot gets in. If the flight is planned so that the descent is done with less than two gallons in each wing, the pilot selects the fuselage tank for the descent and landing. Regardless of the flight planning, the pilot can use all the wing fuel in level flight or climb (There is less than 0.1 gallon unusable). He can use all but one gallon per wing in a normal descent and all but two gallons per wing in a steep descent. All fuselage fuel can be used in any attitude.

Addition of the selectable fuselage tank gives the pilot a much more accurate indication of his last few gallons fuel, thus increasing range and decreasing his concern of exact usable fuel state when fuel is low. It also gives redundant backup for things like fuel vent blockage, loss of fuel cap, etc. It does require fuel management though, but not more so than with the pump. The fuel selector is designed to mildly interfere with the pilots wrist to remind him not to take off with the fuselage selected, thus depleting descent fuel first.

The selector handle is positioned left for wings, up for fuselage, and right for off. The selector valve is operated directly with a torque tube running forward. The torque tube is easy to install even with the side consoles in place. The torque tube has a mild curve which positions it against the fuselage side from F.S. 70 to F.S. 90, thus it does not interfere with the suitcase. Route holes in bulkheads as required

The system low point is provided with a drain adjacent to the selector valve. The drain is installed by drilling a five-sixteenth inch hole in the AN910-2D coupling and tapping with a 1/8-27 N.P.T. tapered pipe tap.

The fuselage tank is located forward of the firewall over the wing spar. The fuselage tank in N4EZ (see photo) is fiberglass. The front and back sides are three-eight inch urethane (or PVC) foam with one ply BID on the inside. The top, bottom-and sides are two plies BID, laid up flat like the practice piece on page 3-13 of Section I. The pieces are assembled with epoxy, then the corners are rounded and two plies BID are laid over all the outside (overly wet layup to avoid leaks). The

sight gauge, vent, cap, strainer, and fuel outlet are made similar to the wing tanks.

The tank was bonded to the spar on the bottom with wet micro and a block of six-pound PVC foam and bonded to the roof at the top (around fuel cap) with a ring of PVC and wet micro. While this looks like it will work okay, it's probably a better idea to fabricate some metal straps and bolt the tank to the firewall. If your tank interferes with the canopy brace bar, move the bar forward. A welded aluminum tank could be substituted if desired, or better yet, maybe we can talk Ken Brock into making a rotary-molded one like the original header tank.

One builder has told us that the Bendix-Strongberg carburetor will function satisfactorily with a very low fuel head and should work well with this new fuel system. We have not tested the Bendix carburetor so we have to leave verification of this up to you.

Some of you may not like the idea of a fuel tank within the confines of the cockpit. This is, however, a fairly common practice for many lightplanes. We feel that the advantages of more reliable fuel flow near zero fuel level, outweighs any disadvantages and thus recommend that you install this new system in your VariEze. Detail drawings on page 6.

Make the following changes to your Owners Manual, Section IV.

Check List	Engine start--add "select fuselage tank" before "mixture rich." Before takeoff--add "wings" after "valve on. Descent--omit "if low fuel refill header tank each six minutes." Add "select fuselage tank if wings are less than two gallons each."

CP11, Page 5

NUMEROUS SKETCHES, TEXT AND TABLES OF NEW VARIEZE FUEL SYSTEM OMITTED

CP10, Page 6

OWNERS MANUAL CHANGES, CONT:

Page seven- Fuel System	Omit entire section. Add "The fuel system consists of two wing tanks and a small fuselage tank, all equipped with visual sight gauges. A three-way selector is located on the pilot's right console. The selector is positioned left to select wing fuel, up to select fuselage fuel, and right to off. The wings hold about twenty-four gallons total, all is usable for climb or level flight. One to two gallons per

	tank are not usable for steep descents. The fuselage tank holds about 2.5 gallons, all is usable in all normal attitudes. Drains are provided at the wing tanks and at the fuel valve (system low point). The wing tanks are vented together to maintain equal tank fuel levels."
Page fifteen-Descent	Omit last paragraph. Add "If a long normal descent is made with less than one gallon of fuel in each wing tank, fuel starvation may occur. Fuel flow can be regained by selecting the fuselage tank or by reducing descent angle. Starvation can occur during long steep descents with two gallons per wing tank. Because of this possibility, the fuselage tank should be selected for all descents and landings, with less than two gallons per wing tank.
Page thirty-two-Appendix I	Omit sentence on safeting fuel valve. Under weight and balance add "check aft cg limit with full fuselage fuel."
Page twenty-two-Engine Failure	Omit all of the top paragraph after "fuel starvation." Add "select fuselage tank. If wing fuel starvation occurred during descent, the wings may have one to two gallons of fuel that is still usable during level flight or climb."

VARIEZE PLANS CHANGES

We are still getting a large volume of questions from builders over the phone and by mail that are answered in the plans or in newsletter #10. Read everything thoroughly before you start bugging us! Transcribe all plans changes into your plans--don't try to memorize them.

Page Number	Changes
5-6	A few builders have had problems getting enough elevon travel. We now recommend that you modify the elevon location template--jig block "B" as shown in the sketch. This will give enough travel even if your canard is not quite straight. **SKETCH OMITTED**
6-21	The Radio Shack switch is not a spring-to-center type. A Micro switch #8A-2041 should be used.
7-1	The four UND skin plies are considerably oversize as shown (fifty-five inches by thirty inches) and may be reduced to fifty inches long and twenty inches wide at root.
17-3	1.15" should be 1.25" (NG6)
7-2	The middle sketch at the top of the

	page should look like this. **SKETCH OMITTED** Use the drawing at the bottom of 7-2 to cut the winglet planform, not the info at the top of page 7-1.
8-7	Add these instructions to the end of Step 8: Before mounting the fuel tanks, round the edges of the wing fitting plates and layup a three-inch strip of UND wrapped twice around the centersection spar as shown. This provides a glass surface for the cowling lip layup (see Section IIA), stiffens the spar end, and safeties the wing fitting screws. **SKETCHES OMITTED**
15-1	The two 5.4 by 2.7 inch pieces of medium density PVC foam should be 5.4 by 3.2 rough to allow for matching the contour of the seat back. **SKETCH OMITTED**
17-5,2-2 & 2-3	(One each) AN5-37A bolt should be AN5-40A. The 37A is adequate if your pad was not laid on too wet. (Two each) AN4-36A bolts should be AN4-40A. (Eight each) AN509-10R-9 should be AN509-10R-14.
20-2	#38 drill should be #42
21-6	3000 feet should be 1500 feet.
22-8	You may want longer canopy hinge screws than the 509-10R-6's shown if your canopy frame is thicker than the prototype N4EZ. Get as much grip as possible.
22-7	Blank should read "See page 25-1."
22-8	AN509-10R-12 should be AN509-10R-10.
Section IV Owners Manual Page 48	Add the following notes: Subtract one hundred feet from the ground roll if landing brake is used. Also: Subtract four hundred feet from the landing distance over a fifty foot obstacle if the landing brake is used.
Section IIA Page 5	B.L. of lower mount points should be B.L. 5.25, not 5.5.
Section IIA Page 10	All three weatherhead fittings should be drilled out to an inside diameter of .281 (9/32) to increase fuel flow. Also: AN42B-4 should be AN42-7A. (These do not apply to the new fuel system).
Section IIA Page 13	Continental #53627 should be #530627. Also: AN844 should be AN884.

VARIEZE PLANS CHANGES, CONT.

Canard Pusher #10	K1000-3 should be K1000-4.
Page 5	
Page 6	Top right-hand corner, 10-5 should be 10-3.
Section IIA	Omit Step four and Step twelve. Modify Step five as shown in this newsletter. Omit photo of valve on page twenty. Substitute fuel system shown in this newsletter. Do the fuel flow checks in Step twelve for the wing and fuselage fuel.

STRUCTURAL TESTING

We have conducted another VariEze static load test since newsletter 10. A homebuilder brought his canard to our shop to show the problems he had in construction. He knew that the canard did not meet the quality control criteria (a large depression in the spar at B.L.42, many dry areas, and inadequate skin overlap at the trailing edge) so he had rejected it. He left the canard with us so we could use it to show others how not to do the work. We decided to load it to destruction to determine its actual strength.

The canard was mounted in a fixture (see photo) that mounted it by the lift tabs and trailing-edge pins similar to the normal mounting on a VariEze fuselage. Test results showed that the strength of the canard was considerably reduced due to the construction errors, but the canard was still strong enough to meet FAR 23 (failure above 150% of limit). Failure occurred at the depression in the top spar. **SKETCH OMITTED**

Another builder showed up at a workshop with a test fixture he had constructed. His eyeball engineering had told him that the canard lift tab was too weak, so he built a 2-ft span of a canard complete with lift tab built to the plans. The canard section was supported at the tips and he applied 2200 lb to the single lift tab - no failure occurred. Needless to say he is no longer worried about lift tab strength!

HAM RADIO OPERATORS

Ivan Whitehouse (Goldendale, Washington), K7ATX, reports about twelve hams have joined the "VariEze" net. He reports poor luck with the Tuesday evening net and says that they will try Thursdays at seven a.m. on 3900 Khz.

ED HAMLIN WANTS YOU!

Ed Hamlin (8377 Seeno Ave, Roseville Ca 95678) was the host of the Sacramento VariEze seminar. He is organizing a "squadron" - a club for EZ builders in central/northern Calif. Purpose is to work together to help each other with building and flying problems and to promote Sport Aviation. If you are interested, send him a S.A.S.E. for his newsletter. Ed has done real first-class work on his half-completed VariEze.

NEW FUEL SYSTEM IN N4EZ - SEE PAGE 5 AND 6. **PHOTOS OMITTED**

Minnesota already has a VariEze club.
Contact George Wilson
2924 108 th Lane NW
Coon Rapids MN 55433

VARI EZE DISTRIBUTOR STATUS

JIRAN - Producing 4 main gear per day and 3 cowlings. Current backlog approximately 9 weeks.

COWLEY - Shipment within two weeks

BROCK - Most items available for immediate shipment. Wing fittings, engine mounts, and nose gear castings backlogged about 2 months.

AIRCRAFT SPRUCE & WICKS ORGAN - most items avail. immediately; a few long lead items make full shipset deliveries about 1 to 2 months. On the average, two complete shipsets per day have been delivered to homebuilders in the first 5 months of the VariEze program. This is an excellent record, unsurpassed by any other homebuilt kit supplier.

THIS IS FROM A RECENT PRESS RELEASE FROM NASA!
COMPOSITE MATERIALS.
During the coming fiscal year NASA plans on intensive effort to reduce the weight and labor-intensive areas on today's production aircraft, with particular emphasis on composite materials (plastics, etc.). At this point all agree that composite materials are hopelessly expensive for aircraft use - both in actual dollars and also because (again) they raise the specter of enormous product liability insurance cost. NASA is coordinating its research with that of others in the "consumer item" fields (principally auto manufacturers) to try to bring costs down and technology up. NASA admits there is much still unknown and expects that it will be a 6-7 year effort before results appear in the tie-down areas.

The next generation of business jet may have winglets too. The new Gulfstream III will make its first flight in 1978. **PHOTO OMITTED**

VARIEZE BUILDER REPORTS

You guys don't write much but we do get a few pictures.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Nat Puffer's canard, elevons and center section foam core.

Cy Mehling's (Doylestown, Pennsylvania) airplane as of early December. Photo taken 3 months after receipt of kit.

Tom Kuffel's (Anchorage, Alaska) first knife trim... at three a.m.! That's loyalty!

Nat Puffer's wings and center section spar completed and aligned. Anybody recognize the thing hanging from the roof?

Puffer's rudders ready for the bottom rib.

K. Kuffel - the First hot wire cut.

Dr. Wagner's fuel tank going together.

Hans Steinhoff (Goleta, California) has the right idea on weight--his wings and canard had to be tied down! (Well... it's a nice idea anyway.)

Dr. John Wagner shaping his canopy frame.

A.G. Ebel's airplane after four months work. December 8, 1976.

VariEze S/N 124's canard doubling as a park bench. This is not recommended. That much weight concentrated on a sharp saw horse can damage the structure. If you do this, place a foam block on the sawhorse first.

Cy Mehling's airplane in October.

WHO'S BUILDING The best way to find VariViggen or VariEze builders in your area, is to attend your local EAA meeting and ask who is building. If you're building a VariViggen or VariEze, clip out the card below, fill in, and mail to EAA, PO Bx 229, Hales Corners, Wi. 53130, attn: A/C Records Dept

CP11, Page 9

VARI EZE REFERENCE DIMENSIONS
This sketch gives a summary of fuselage stations and butt lines which are easily checked on the completed airplane. All of this information is in the plans but some of it you have to hunt for. The points marked by the asterisk (*) should be checked during final weight and balance and the real values recorded in your airframe log (Drop plumb-bob to lines on floor). **SKETCHES OMITTED**

VARIVIGGEN PLANS CHANGES

Page	Change
VariViggen Plans Page 5	Top of WS 28 should be 3.1 not 3.0 as shown.
SP Wing Plans Page 14	AA-3 should be two required-1/4 inch 2024-T3 aluminum 1.0 by 12.4.
SP Wing Plans Page 13	Under wood--two pieces 1.0 by 1.5 by 24 should be four pieces.

VARIVIGGEN BUILDER REPORTS

Ken Guscott, S/N 129, reports that he has the fuselage and inboard wing complete and ready for cover. Ken says that he's disappointed that more VariViggen builders haven't been sending information in for the newsletter. We agree. What are you guys up to?!

Jim Cavis reports that his airplane is ready for first flight, paint and all. He is mounting the canopy plexiglass now and as soon as he finishes we'll have a genuine flight report for you to read. Jim has the standard wing plan form on his airplane but built it from foam and glass. He plans to fly it in standard configuration and later add winglets. This should be interesting.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

The Stow, Mass. construction seminar. Photos courtesy of Charles Douette.

Ken Guscott's front cockpit layout. Note the electric trim & reflex.

Cuscott's fuselage and wing ready for skins

Ken Guscott's chain drive nose gear retraction mechanism.

IMPORTANT ADDITION TO NEWSLETTER 11 - SIMPLE SPOILERS AID ROLL CONTROL

AFTER NEWSLETTER 11 had gone to press we invited Peter Garrison, an aviation writer for "Flying" magazine, to fly N4EZ. He flew it several times and was pleased with the improvements due to the speed brake; however, he expressed concern that the airplane may be a "handful" for a low-proficiency pilot, due to its relatively sluggish roll rate and due to a tendency to pitch nose-down with aileron inputs. These comments caused us concern, and a little surprise, since we hadn't really been aware of a significant pitch change with aileron. We flew the airplane again and noted that, yes, indeed there is an objectionable nose-down pitch change, but only for large aileron inputs. Apparently we generally use only small aileron inputs and a lot of rudder when needed for high roll rates and, being accustomed to flying the airplane in this manner, we were not of the opinion that the airplane was difficult to maneuver. Trying to put ourselves in the place of a low-proficiency pilot on his first VariEze flight where he may be flying an airplane out-of-trim and might be unable to roll at all, if he is using a lot of opposite rudder, led to the conclusion that Peter was right; the airplane does need to be improved to make it safe for some pilots.

We have always been reluctant to put rear-wing ailerons on the VariEze due to the control system complexity, the need to hookup controls for wing removal, and the addition of a new possible flutter mode. What we needed was some additional roll rate, a slight nose-up pitch change with roll deflection, and perhaps some proverse yaw. We rigged up a small spoiler on the cowling just aft of the centersection spar, and found that its deflection almost exactly canceled the nose-down pitch and made the roll rate higher. Addition of this spoiler made the roll response more crisp and made the VariEze feel more like a conventional

airplane. It was a little hard for us to believe that this small spoiler, mounted that far inboard, was really making that much difference; so we invited Peter up again to fly our modification. He was skeptical because of the small size and placement of the spoilers, but after his flight, which included maneuvering at all speeds and several landings, he agreed that all pitch change due to roll was gone and that roll control was more like a conventional aircraft. When asked if the aircraft was safer for the low proficiency pilot, he replied, "Definitely." We agree, and are therefore recommending the simple spoiler system shown below as a mandatory addition to your VariEze.

The spoilers have a negligible effect on cruise speed. They are far enough from the leading edge to be included in the boundary layer. There are no changes to the current control system. The elevons still work normally; the spoilers are merely an addition. A bracket (CS18) is bolted on the stick using the existing bolt. Cables (in nyloflo conduits) are routed aft along the fuselage side (no interference with the suitcase) and through the centersection spar. These cables rotate tubes which directly deploy the flat-plate spoilers, through four slots in the top cowl. One light spring per spoiler holds them down against the cowl. CS18 is offset such that only a very minor slack exists in one cable when the opposite spoiler is fully deployed. The complete system was designed to be easily installed in a completed airplane. It was built and installed in N4EZ in one day. The front half of the pilot's armrest was removed for access and reinstalled with flox after spoiler installation. Note that the armrest side must be hollowed locally to provide clearance with CS18. No turnbuckles were used. The cable Nicopress sleeves were swaged as accurately as possible, then final adjustment was made by moving the CS19 block up and down. The spoilers are rigged to start moving up just as the stick moves away from neutral and to reach full deflection (about 50 degrees with no airload) at full roll control. Spoiler rigging is effected only slightly by fore-aft stick motion (pitch control). Be sure it's hooked up so the left spoiler deflects when the stick goes left (the cables cross under the rear armrest). The cables are routed on both sides of the front seatbelt attachment.

The spoilers are plates of .063 2024T3 aluminum. At neutral, they sit flat on top of the cowling. They are attached to a weldment with two AN525-10R6 screws per spoiler. Cowling removal requires removing the four screws, or the cowling can be slotted forward to allow removal without disturbing the spoilers. The weldment consists of 1/2-inch dia. steel tubes with pivots and brackets. The right side has two hinges: one at B.L.8.4R where the cable attaches and the other between the two spoiler mounting tabs (CS24's). The left side has three hinges: one between the CS24 tabs, one at B.L.131, and one at the cable attach point. Because of the spar dihedral, a universal joint is required at B.L.12L

Four hinge brackets (.063 alum formed angle) are bolted to the centersection spar (CS20 and three CS21). They are mounted wet with flox and the excess flox squeeze-out prevents rotation should the metal bond fail, thus only one mounting bolt is required. These brackets are drilled in last, with the entire assembly bolted together, to allow adjustment so the spoilers sit flat on top of the cowl.

A small steel spacer, the same as that used at the bottom of the rudder pedal (VECS13), is used at each of the five hinge points. The 1/4" OD spacer is clamped to the aluminum brackets by the AN3 bolts and the steel brackets rotate on them

One spring is used per spoiler. It is installed as shown using an AN100-3 thimble through one of the CS24 brackets. The spring is sewn to the thimble and to the bottom cowl flange with two loops of .041 safety wire. Adjust for a very light snub in the neutral position. The spring is a C-133 type (Century Spring Corp., L.A.). We found it at the local hardware store. You can substitute any spring with a spring rate of about two pounds per inch deflection. Do not substitute a heavy spring like a screen-door type.

Full-size patterns are shown, to be used to make the required brackets. When the brackets are welded to the tubes be sure to align them as shown. Install the Nyloflo conduits as follows: first sand their surface dull for bonding, string them into the airplane as shown. Bond them to the spar and armrest in the rear (flox/5-min); let cure. Pull them tight at the front to straighten them, tape to the side between FS65 and 95 and bond every eight inches with a blob of flox/5-min. Glue the forward block (CS19) to the side, floor, and armrest, potting the formed curve in the tube with a lot of 5-min/flox. CS19 is glued in last, so its vertical position can be adjusted to final-adjust cable rigging. With the Nyloflow tubes mounted straight, very little cable friction will exist. Do not use Nyloseal tube.

OWNERS MANUAL ADDITIONS

ADD THE FOLLOWING to page 7 of your owners manual: "small spoilers located on the centersection of the aft wing are used to augment the roll control."

INSERT the following to replace the landing gear speed data on page 17 of your Owners Manual- "Don't extend gear above 100 kt(115 mph) - at higher speeds the airloads make it hard to extend. Gear can be down or can be retracted at speeds up to 140 kt(163 mph)

ADDITIONAL NEW ITEMS

THE PLANS AND PREVIOUS newsletters indicated that it may be acceptable to use larger tires on the main gear of the VariEze. This may not be so. Cowley's VariEze has experienced a severe fore-aft resonance (vibration fore-aft) of the wheel when taxiing at a medium speed (about 15-20 mph). This may be due in part to a high spot or grabbing of the brake disc (his disc thickness was not uniform), but it may also be caused by resonance excited due to the larger (and heavier tire). This vibration at 20 mph is sometimes evident on N4EZ with the 3.40x3x5 tires but it is only mild and intermittent. It does not occur at higher or lower speeds. CHECK YOUR DISC THICKNESS!

One builder brought in a canard/elevon assembly in which he thought his elevon up-travel was only 21 deg, instead of the required 24 degrees. On closer inspection we found that the trailing edge of his canard was a bit high, making his elevon template read -3 degrees when the elevon was at zero, and thus his elevon travel was adequate (24 deg). If you suspect that your elevon degree template is giving the wrong

information, place jig block B, page 5-6 under your canard to line up zero elevon deflection, then check that the elevon degree template reads zero.

Peter Garrison landing N4EZ. Note new spoilers & landing brake.
PHOTO OMITTED

CP11, Page A1

SKETCHES OF VARIEZE SPOILER SYSTEM OMITTED

CP11, Page A2

SKETCHES OF VARIEZE SPOILER SYSTEM OMITTED

CP11, Page A3

SKETCHES OF VARIEZE SPOILER SYSTEM OMITTED

CP11, Page A4

BELOW IS VARIEZE SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIEZE TWO-PLACE SPORTPLANE

**PHOTOS OMITTED

THE STORY
For the last 12 months, we have refrained from promotional activities and marketing on the VariEze to concentrate totally on its development and setting up materials and components distribution. In this short time, we have 1. flown a full 350 flight-hour test program on two prototypes, one Continental and one VW-powered, 2. completed full structural qualification testing, 3. prepared a manual for the amateur builder to educate him in the structural materials and to guide him through construction, 4. set up a materials distribution system through established, competent distributors.

THE TEST PROGRAM
The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE RESULTS
The VariEze has superb flying qualities for its primary mission - comfortable travel. It has excellent hands-off stability even in turbulence. It is unusually safe at low speeds, can be flown with full aft stick (47 kt) without being susceptible to departure or spin, regardless of attitude or power. Performance is also superb - cruise

up to 200 mph and climb up to 1700 fpm at gross weight with the larger engines.

THE MISSION: PRACTICAL UTILITY
Although quite compact outside, the VariEze provides unusual comfort for up to 6-ft, 7-in, 210-lb pilots and 6-ft, 5-in, 220-lb passengers, plus two medium-size suitcases and four small baggage areas. The 24-gallon fuel load allows up to 1000-mile range at economy cruise. High altitude climb is excellent, for flying over turbulence, mountain ranges, and for satisfactory high-density altitude take offs.

THE DESIGN
The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic systems design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE STRUCTURE
New composite sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, longer life, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair.

THE HOMEBUILDER SUPPORT
The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations. Construction seminars are provided at RAF and elsewhere.

THE AVAILABLE HOMEBUILT
Established, competent distributors have stocked materials and components before the aircraft was marketed. All raw materials are now available plus many prefabricated items including canopy, landing gear, wing quick-disconnect fittings, cowling, all machined items, rudder pedals, engine mounts, suitcases and upholstery. If you choose to purchase all prefab parts, you can build your VariEze in about 500 man-hours - really!

VariEze documentation is available in five sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full-size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words! The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, A75, C85, C90, 0-200
SECTION IIB - VW engines (avail. Oct '76)

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system, avionics, landing and position lights, antennas, starter. Avail Sept. 76

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim. Avail Sept 76

Specs & performance with 100-hp Continental.fixed-pitch prop.@ gross weight

Take Off	800 ft
Climb	1700 fpm
Max Cruise	200 mph
Econ Cruise	165 mph
Range @ Max Cruise	720 mi
Range @ Econ Cruise	980 mi
Min Speed (full aft stick)	49 kt
Landing	900 ft
Canard Span/Area	12.5'/13 square feet
Wing Span/Area	22.2'/53.6 square feet
Empty Weight	520 lb
Gross Weight	1050 lb

Specs & performance with 75-hp Continental

Take Off	950 ft
Climb	950 fpm
Max Cruise	178 mph
Econ Cruise	145 mph
Empty Weight	490 lb
Gross Weight	950 lb

Check items desired:	Price, including First class mail U S and Canada	Air mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher' newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$94.00	$108.00
Section IIA		

or	$19.00	$21.00
Section IIB		
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00

Calif. residence add 6% tax
on all items except newsletter
* U.S. funds only

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft stick	49 mph
	Landing	500 ft
Performance with 150-hp. Special Performance Wings	Climb	1000 fpm
	Cruise	158 mph
Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 square feet
	Wing Span/Area	19 ft/119 square feet
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications Special Performance Wing	Wing Span/Area	23.7 ft/125 square feet
	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION

The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price: $4.75 per year first class mail, $6.50 air mail overseas. Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing, 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described. Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles. Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional

radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price: $4.75 first class mail, $5.50 air mail overseas.

The following are RAF-authorized distributors of materials and components. Items indicated have been developed under RAF approval and are recommended for VariViggen or VariEze aircraft. Contact the distributors at the address shown for his catalog and description of items. Indicate to him that you are a VariViggen or VariEze builder.

AIRCRAFT SPRUCE & SPECIALTY CO.
201 W. Truslow Ave.
Box 424
Fullerton, Ca. 92632
(714) 870-7551

OR

WICKS AIRCRAFT SUPPLY
1100 5th Street
Highland, Il. 62249
(618) 654-2191

Catalog cost $2 - Refundable at first order.
VariEze materials: epoxies, foams, fiberglass, filler materials, wood, metals, all hardware, specialized tools, skin barrier cream, seat belt/shoulder harness sets, wheels & brakes & custom upholstery/suitcases.
VariViggen materials: spruce kit, plywood kit, hardware, aluminum & fiberglass.

KEN BROCK MANUFACTURING
11852 Western Ave.
Stanton, Ca. 96080
(714) 898-4366

Catalog cost $1 - Refundable at first purchase.

VariEze prefabricated components: wing attach/quick disconnect assemblies, nose gear machined parts, control system components, fuel cap assemblies, welded engine mounts, welded stick assembly, welded rudder pedals, wheels & brakes.
VariViggen prefabricated components: all machined parts.

FRED JIRAN GLIDER REPAIR Write for brochure.
Building 6, Mojave Airport
Mojave, Ca. 93501
(805) 824-4558
VariEze prefabricated components: Molded S-glass main gear and nose gear struts, nose gear strut cover, nose gear box.

COWLEY ENTERPRISES Write for brochure.
P.O. Box 14
Santa Paula, Ca. 93060
(805) 525-5829
VariEze plexiglass canopy - Light bronze tint or clear.

H. C. COMMUNICATIONS Write for brochure.
Box 2047
Canoga Park, Ca. 91306
VariEze and VariViggen custom COM & NAV VHF antennas.

MONNETT EXPERIMENTAL AIRCRAFT, INC. Ask about VariViggen parts.
955 Grace St.
Elgin, Il. 60120
(312) 741-2223
VariEze - None
VariViggen - All molded fiberglass parts

GOUGEON BROTHERS Write for brochure.
706 Martin St.
Bay City, Mi. 48706
VariEze - None
VariViggen - 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS Contact him for list
4102 Twining
Riverside, Ca. 92509
VariEze - None
VariViggen - welded nose and main landing gear, 1-1/4" sq. steel tube.

BILL CAMPBELL (VariViggen builder) Contact him for list.
Box 253
Phelan, Ca. 92371
VariEze - None
VariViggen - Prefab brackets and fittings.

JESSE WRIGHT Contact him for list.
7221 S. Colorado Ct.
Littleton, Co. 80122
VariEze - none
VariViggen - prefab wood parts.

THE CANARD PUSHER No 12 Apr 77

NEWS OF THE VARIVIGGEN AND VARIEZE PROGRAMS
(very vig-in) (very easy)

NEWSLETTER SUBSCRIPTION - $4.75/yr
OVERSEAS SUBSCRIPTION - $6.50/yr
BACK ISSUES - $1.00 each

PUBLISHED QUARTERLY BY
JAN, APL, JLY, OCT

RUTAN AIRCRAFT FACTORY
Bldg. 13, Mojave Airport
P.O. Box 656, Mojave, CA 93501
(805)-824-2645

RAF ACTIVITY since the January Newsletter has included homebuilders support, construction workshops, more design work for NASA, and a move. The landing brake plans were completed in February--They are VariEze Section VI ($10, $11 overseas). They consist of five 18" x 24" sheets, all full-size drawings.

N4EZ, our VariEze homebuilt prototype, has been flying extensively over the last few months, including several long trips: 2000 miles for the Seattle workshop and nearly 3000 miles for the trip which included the Denver workshop. With the exception of some exhaust system cracks the airplane has been maintenance-free. Rides or checkouts have been given to several writers for "Flying" and "Aviation Consumer" magazines. Both plan articles soon. The VariEze has appeared in the following magazines lately: Plane and Pilot, Sport Planes, Sport Flying.

We have completed the last of our out-of-town composite construction workshops. These have proven to be very beneficial in disseminating the techniques of foam/glass construction. Cities in which the workshops were given are listed.

Oshkosh, Wis.
Highland, Ill.
Boston, Mass.
Van Nuys, Ca.
London, England
Paris, France
Austin, Tex.
Sacramento, Ca.
Atlanta, Ga.
Daytona Beach, Fla.
Snohomish, Wash.
Denver, Colo.
Anderson, Ind.
St. Paul, Minn.

We will also continue to have an occasional workshop and flight demo here at Mojave to assist builders with construction questions. The next scheduled demos at Mojave are noon to 2 p.m. on May 14 and on June 11. We also plan to fly N4EZ to the Watsonville Flyin May 28 and to the Chino Flyin April 30.

RAF has finally made the move to our new building on the flightline at Mojave and the airplanes are on display for visitors to stop by and see. Our regular office hours are 9 a.m. to 5 p.m. Wednesday through Saturday. We are closed to visitors Sunday, Monday, and Tuesday. Builders who have pressing problems may be able to catch us by phone on our closed days, but we may be out in the shop with epoxy up to our armpits, so try and call Wednesday through Saturday if you can.

The VariViggen homebuilt program has suffered a tragic beginning. Jim Cavis was seriously injured when an accident occurred during his initial tests. A report on this accident is included in this Newsletter.

The VariEze homebuilt program has started on a more positive note with four homebuilt airplanes now flying, and many more soon to fly. However, the VariEze record so far has not been good. One ended up being run through a snowbank removing all three gear and damaging the propeller when it veered off the runway on its first lift-off. Factors contributing to this included a gusty crosswind, one brake being stronger than the other due to a modification, and incorrect rigging of stops in the elevon control system. That airplane has been repaired and is now flying successfully. We are concerned about the safety of many of you who will be conducting your flight tests, since we have observed an almost appalling lack of good judgment of many who have and are doing test work. Some have had a complete disregard of the limitations and procedures in the Owners Manual and have overlooked important things like weight and balance, rigging of controls, etc. It seems unbelievable that anyone can spend so much work building an airplane, then be so sloppy when it comes to flying it. We have also noted that many builders are not familiar with many of the changes and additions in previous Newsletters. Be sure you copy all info from Newsletter #10, #11, and #12 completely into your plans and Owners Manual. A lot of this information is very important to you! A large portion of this newsletter is devoted to preaching and emphasizing the importance of quality control, careful conduct of your test program, and of following known limitations.

PHOTO OF WICK'S ORGAN COMPANY'S 101MW OMITTED

WEIGHT AND BALANCE AND INITIAL TESTING

The "lead" builders of both the VariViggen and the VariEze have begun to roll airplanes out of their garages and into hangars. RAF has been trying to keep tabs on these early birds and one alarming deficiency has been common to many: inadequate and inaccurate weight and balance. Now hear this all of you homebuilders: A slipshod weight and balance can kill you. The final weight and balance that you do on your airplane before flight testing begins is just as important as installing the wing attachment bolts. Use the weight and balance methods shown in your Owners Manuals!

A variation of "Murphy's Law" says that anything which can be misunderstood or ignored will be. Our weight and balance instructions are no exception. The first principle of a good weight and balance is to assume nothing. For example, you can't just assume that the nose and main gear stations are exactly as shown in the Owners Manual. It wouldn't be unusual to find that your main gear axle centerlines are as much as 0.5 inch or more off of the target of F.S. 108.0. A small

variation in gear location won't adversely affect the way your airplane flies, but it could lead you to believe that your center of gravity is forward (or aft) of its true location by quite a bit! The same principle applies to temporary ballast weights used to keep the airplanes nose firmly on the scales. You may find it more convenient to put your ballast weight in a different place than we show in the Owners Manual which is ok. But, when you make your calculations use the weight and fuselage station where you put the weight, and not our sample! Also do a weight and balance with the pilot in the airplane to check your calculations. Do not ignore the pilot weight placard in the Owners Manual. Be sure to check the dimensions shown on Page 10 of Newsletter #11 while you are checking gear reaction points.

Those builders who have convinced themselves that the world will stop turning if they don't have alternators, vacuum pumps, or starters on their airplanes will probably discover that the airplane is 1) overweight and 2) aft CG. If you discover this condition in your airplane you only have two options, you can remove the garbage that is causing the aft CG condition and help your weight at the same time, or you can add permanent ballast in the nose to get your CG where it belongs and make your overweight airplane even heavier. Not really much of a choice. If you can't part with your heavy accessories, you will be tempted to ballast just enough to get to the aft CG limit and you will be asking for trouble. We have established a limited "first flight" area on the allowable weight versus fuselage station graph in the Owners Manual. Your initial flight testing must begin within this area. The first flight box is expanded slowly and carefully as you and your airplane gain experience. You can't start your flying at the most aft (or most forward) CG that we recommended for fully proficient pilots and proven airplanes and expect to be safe! Don't compromise safety for the sake of a few unnecessary gadgets! Read and follow all information available to you. You are building a high performance airplane, not a toy. As you begin your testing be sure to give someone else besides the test pilot the responsibility to check that the airplane is ready, the Owners Manual procedures are being followed, and all limitations are met. He should also have the authority to make the "go", "no-go" decision and do the test planning. Test pilots have too much else to think about to be able to make correct decisions on these things.

Already we have seen people doing some really foolish things like flying without side consoles (the right one provides pitch stops!), doing initial testing in crosswinds of almost the full capability of the airplane (Owners Manual specifies zero for initial tests), testing on shorter runways than specified, etc. Unless you stay within recommended limits your chances of success are quite low.

When you get to the hangar with your new airplane take it easy, and do a thorough job of your initial systems checks, weight and balance, etc. This is not the time to hurry. "Homebuilderitis" effects us all and you will lust to see your airplane fly, fast! Don't talk yourself into doing something stupid just to please your ego; finish building the airplane before you try to fly it!

WEIGHT CONTROL

In view of the non-stop preaching done by RAF in our newsletters, plans, over the telephone, and in person, it is a little difficult for us to understand why some homebuilders are still happily ruining their airplanes by making them overweight. The VariEze is also VariSmall and it doesn't have a great deal of wing area. Adding a little weight to your airplane is like carrying another passenger in a Cessna 172!

The worst weight offenders are still the gadgeteers. Starters, generators, alternators, vacuum pumps, radios, gyro instruments, dual controls, etc., etc. One group of builders added dual 720-channel NAV/Coms, Dual VOR/ILS indicators, dual glide slopes, an annunciator panel, D.M.E., marker beacon, transponder, encoding altimeter, artificial horizon, directional gyro, rate of climb, turn and bank, starter wiring, nightlights, CHT and EGT, a 25-pound battery, and an alternator to power it all. Aside from the $14,000 expense, the airplane is 140 pounds overweight! Unfortunately, this equipment was also on an aircraft finished with over 11 gallons of Featherfil and 6 gallons of white paint (N4EZ has 5 quarts and 1.3 gallons respectively). This airplane is so heavy that a normal pilot can't even operate within the "first flight" limits shown in the Owners Manual. All of the gadgetry in this Vari-Heavy belongs in a 747, not in a little homebuilt! This airplane is now a single-place. It can happen to you, too, if you lose appreciation for weight control.

N4EZ started life with an 11-pound alternator on the engine and had to have 10 pounds of lead in the nose to balance properly. We really thought that the alternator was necessary to power our little NAV/COM on long trips. Well, we were wrong. The voltage regulator burned out on a trip to Seattle and since we were too busy to fix it right away, we charged up the little 12 Amp-hour motorcycle battery and flew another 3000 miles. Controlled airspace, radio navigation, and weather reports, we used the radio as much as ever and the battery was still strong when the trip was over. Obviously, once home, we ripped the alternator off, took the lead out of the nose, and put the voltage regulator on a polished mahogany plaque. That little voltage regulator helped us take 21 lbs. off of N4EZ's empty weight! You hard core gadgeteers should spend your efforts finding things that can be taken out to save weight, not hunting for space to add expensive and heavy grozmos!

The second major weight offender is the finishing nut. We have heard stories of builders who use Bondo on airplanes for finishing. Bondo weighs 12 pounds per gallon. Dry micro only weighs 3 pounds per gallon. We hear reports of gallons of Featherfil being used where quarts should do. ARRGH! If you wonder why we are getting gray hair, it's because you can wipe out weeks of design refinement and weight saving efforts with a stroke of your Bondo paddle!

Read and use Section V carefully and conscientiously. Don't ruin your airplane trying to make it into a sculpture! A Cessna 150 leaves the paint and finish shop only 13 pounds heavier than it went in, and it has more than twice the surface area of VariEze. N4EZ's finish weighs 18 pounds and we think that's too heavy. If you add over 20 pounds to your Eze in finishing, you have done yourself a disservice.

There has been some confusion about what to expect for the empty weight of your VariEze. The values shown in the Owners Manual are for a basic airplane without any extra equipment, no electrical system, and minimum weight finish. The average homebuilt VariEze with an 0-200 engine, with the basic electrical system (Section III) and with an average finish job will weigh approximately 600 pounds, empty. This goes the same for a VariViggen, too. While the empty weight is given as 950 pounds, the average equipped airplane will weigh about 1050 pounds.

5:00 X 5 TIRES (THE SAGA OF BIG FOOT)
In Newsletter #11 it was mentioned that the larger and heavier 500X5 tires might be creating a problem with the VariEze landing gear. Since January our suspicions have been confirmed and these "Big Feet" have been trouble with a capital TEE. The bottom line is that the 500X5 tires must not be used on the VariEze. Stick with the recommended 340X300X5; the following explains why.

The Eze landing gear is a lot like a big tuning fork. It has a distinct "natural frequency" that it will vibrate at, when excited. In the fore-aft direction, the once-per-revolution excitation of an unbalanced tire and wheel or a lopsided brake disc can cause the gear leg to vibrate at its natural frequency when the rotational speed of the wheels (Revs per second) is at the natural frequency (cycles per second) of the gear. If the natural vibration of the gear is excited at high speeds where there is a lot of kinetic energy (1/2 MV square), the vibration is violent and damaging. At low speed the vibration is mild and no cause for concern.

On N4EZ the 10-inch diameter (340X3X5) tires have to turn at about 20 mph (11.2 Rev/Sec) to excite a mild gear leg vibration. The larger (15 inch diameter) tires (500X5) have to zip along at a little over 30 mph to excite the gear. The kinetic energy is more than twice as great, and the vibration is strong enough to damage the gear attachment pads.

One builder has also found that his gear vibration was a problem with his brake mounted below the axle and was solved when he moved it 90 degrees to the correct position aft of the strut. The exact position of the Cleveland brake is not clearly shown in the plans. Refer to the drawing below. **SKETCH OMITTED**

BRAKE SERVICING AND BRAKELINE ROUTING
We've talked to a few builders who really didn't understand how to service their brakes with fluid and purge the air bubbles. First of all, aircraft brakes and automobile brakes are different, so don't expect the method you use on your car to work on the airplane. The brakes on VariViggens and VariEzes are your only low speed (0 to 30 mph) directional controls. A spongy brake requires immediate attention.

Aircraft brakes must be serviced by pumping fluid from the wheel brake up through the line into the master cylinder. This may seem basackwards, trying to make the river flow uphill and all that, but it is the correct way to do it. The magic in pumping the fluid from bottom to top is that it forces any air in the system up and out. A pump-type oil can or a squeeze bulb can be used to pump the fluid up through the system.

The routing of your brake lines through the airplane is also very important. The brake lines should run downhill from the master cylinder to the brake without any loops or high spots. **SKETCHES OMITTED**

A loop or high spot, like the sketch shows, can trap a big air bubble and give you a permanently spongy brake that even proper servicing won't help.

SHORT AND MEDIUM HEIGHT PILOTS

We have had a number of calls from medium and short pilots concerned that they might not be able to reach the controls on the VariEze and wondering what mods to make. The most common question asked is "Can I move the stick?" and the answer is no. The pilot should move forward, the stick should not move aft. The short pilot is also generally lighter than tall pilots and has a built-in weight and balance problem requiring permanent ballast in the nose. Moving the light pilot forward will help keep the center of gravity forward where it belongs. The rudder pedals as shown in the plans will adjust enough to fit pilots from 6'4" to 5'5" without changing anything. Medium height pilots may find it necessary to use a cushion to raise their eye-line for adequate visibility.

The short pilots, 5'4" down, who are building VariEze's will need to make some minor modifications to their airplanes for adequate visibility and better control reach. The obvious things to move first are the rudder pedals. The bottom pivot of the rudder pedal as shown in Chapter 17 is at F.S. 17 (approximately) and they can be shifted aft 2 1/2 inches to F.S. 19.5 without any trouble at all. The rudder pedal pivot bolts are simply located 1/2 inch forward of F-22 instead of 3 inches forward as shown on Page 17-8.

The major difference between short people and tall people is the length of their legs. Strangely enough, torso's and arms are fairly standard (compare the range of pants leg lengths with the length range of shirt sleeves on your next trip to the department store). The short troops may need to cushion themselves forward by the thickness of an extra back cushion but not much more for comfortable stick throw. Even 5'2" pilots can easily reach the stick. If you move forward, the canopy tries to force you lower in the cockpit, so as the pilot moves forward, the canopy has to move forward also. As the Owners Manual specifies, the pilot has to stay high in the canopy for good forward visibility. Short troops have two options; they can add one to 3" of foam thickness over the thigh support as a permanent spacer and use the standard seat cushion, or have an extra thick cushion made.

MAIN GEAR TESTING AND MODIFICATIONS

The drop and static load testing of the main landing gear strut has been quite extensive. The accompanying photos show the two types of tests which have been conducted; one test is a static load applied by a hydraulic ram, the other is a more traditional "free drop" test as is specified by F.A.R. part 23. Both types of test showed excellent results, even when using components that were considered rejects. The

drop test components were in most cases (We did test a good one too!) of inferior quality to the parts shipped to builders.

A few builders have asked what the weakest part of the landing gear is, and the answer is the attachment pads. Don't misunderstand, it is strong enough to do the job and then some, but it is the part we expect to break first if the system is overloaded. On N7EZ (VW prototype), it's trip through a ditch at 75 kts last summer tore the gear free of the airplane by failing the attachment layup, but the gear strut itself was not damaged and will be reinstalled on the airplane. We specifically tailored the attachment layup to fail first in a crunch because it is the easiest and cheapest part to replace.

If you choose to strengthen the attachment area, it can be essentially doubled in strength with very little additional weight using this approach. Follow Chapter 18 exactly up to the end of Step 2, then do Step 3 in two parts: First layup the 15 ply inside pad, clamp, and let cure; second, drill the 1/4 inch holes through the inside tab, then sand about 1/8 inch off the red foam tabs front and rear faces, prep sand the MG 1 and layup a 25 ply outside pad, clamp and cure.
SKETCHES OMITTED

The torsional strength of the MG 1 strut can be increased significantly by applying an external BID wrap. This adds little weight and significantly increases its resistance to splitting if a severe aft load is applied. We do recommend that you make the wrap as shown. This can be done even after the gear is mounted to the fuselage, but is better if done full length before the mounting pads are installed.
SKETCHES OMITTED **PHOTOS OF STATIC LOAD AND DROP TEST OMITTED**

VARIEZE ELECTRICAL SYSTEM
Lately we have been attacking the problem of how to provide reliable electrical power for NAV/COM and instruments without using the heavy engine-driven alternator. Note that leaving out the alternator is highly recommended for the heavy 0-200 and is mandatory for the Lycoming 0-235. It seems unreasonable to use a 60 amp alternator to provide power for an average current drain requirement of less than one amp. Why only one amp? Well, the NAV/COM generally needs to be used only five to ten minutes out of every hour. The only exception being touch-and-go's at controlled airports. Since the VariEze is not a training-type airplane, this use is not common. NAV/COM for cross-country needs to be used only in terminal areas or for a few seconds at a time to obtain a bearing or to check weather. Engine instruments (oil temperature/oil pressure) are very low current drain. The turn and bank is required only if you need to extract yourself from poor weather planning and is thus off the vast majority of the time. In summary then, we have found actual average electrical current requirements in N4EZ to be less than one amp, even including trips with all stops at controlled airports.

We are then taking two approaches to developing a satisfactory no-alternator electrical system. The first approach has already been tested on N4EZ for the last two months, including two 2000+ mile trips. It has worked very satisfactorily and its use is recommended. The second approach will be tested soon.

1. No in-flight charging. Convenient self-contained trickle charger to top-off battery when parked or hangared.

The system shown can be built from less than $10 worth of electrical components available at any Radio Shack or electronics supply store. The components can be mounted in a small box on the F-22 bulkhead. Total system weight is one pound. To use the system, simply plug in to any 110-Volt AC receptacle and turn on the switch. We generally give the battery an over-night or one-day charge every 10 to 15 hours flying, or about once a month. On a long trip, charge it over-night when hangared. Charge rate is 1/2 to 3/4 amp and will take about one day to fully charge a low battery. Do not leave it plugged in for extended periods (more than two days), or battery damage can occur. The battery is the same 14 AH Honda 750 motorcycle battery shown in Section III. Note the optional backup battery. This is a small 12-Volt motorcycle battery that can be selected (to use or to charge) if, due to poor planning, you deplete your standard battery. The smallest 12-Volt motorcycle batteries weigh only 4 to 5 pounds and will run your NAV/COM and instruments about an hour continuous.

SKETCH OMITTED

2. Solar-powered electrical. Note that we cannot recommend this as we have not yet tested it.

The solar cell panel shown costs about $170, weighs a few ounces, and should keep the battery charged if ratio of sun-exposure time to radio-use time is in excess of ten. **SKETCH OMITTED**

EXHAUST SYSTEM

One of the four mild carbon steel exhaust stacks on N4EZ developed cracks recently and had to be replaced. The cracks appear to have originated along some deep mandrel marks (left from forming) in the first bend downstream of the exhaust port. The cylinder appears, from exhaust deposits, to have been operated at a normal mixture (one cylinder of an engine doesn't necessarily get the same fuel/air mix as another even though they are hooked to the same carburetor). There are a lot of possibilities open as to the cause of these cracks. The mandrel marks alone could be the culprit. The combination of heat and vibration may require the use of stainless steel instead of carbon steel. It is also possible that the geometry of the exhaust stack is incompatible with the engine for another reason. We are evaluating these possibilities as fast as we can, however this involves flying a lot and many homebuilders will be flying before we have the final answer. This problem doesn't pose any immediate threat to flight safety but until it is resolved you should plan to inspect your exhaust system visually for cracks at least every 25 hours or engine time. In the meantime we will be testing a stainless system (same geometry) to determine if this will solve the problem.

EPOXY

Last October we began working with a large epoxy formulator to develop an alternate supplier of the RAE, RAEF, RAES and 5-minute material for VariEze construction. Meeting our specifications for this material has

not been easy, particularly for RAES. The new material supplied by Applied Plastics is now available at the VariEze distributors, and that it meets or exceeds all previous specifications. It is also less toxic to work with. Most important, we are confident that the quality control problems with the previous vendor will not reoccur. Here's what to look for if you suspect that you have problems with your epoxy. Your epoxy resin (RAE) should be clear or have a slight amber, red, or greenish tint. At 75 degrees its viscosity should be low enough so that it is easily poured. (Cold temperature makes all resins thick). The resin should not be contaminated with particles or lumps floating in it. Thick honey-like resin or contaminated resin should be returned to the place where you bought it. Hardeners may be tinted a variety of colors. A new bottle of hardener may occasionally show a milky sediment in the bottom; warming and shaking should allow this sediment to go back into solution. It should be warmed by placing the jar in hot water (130 to 170 degrees F.) Do this before using a new bottle. If the sediment will not return to solution, the pot life of epoxy mixed using the hardener will be shorter than it should be, so return it to the place of purchase for replacement. If your hardener has crud in it that doesn't drop into solution by warming and shaking, get is replaced, also. 5MIN epoxy is a very quick setting system of high viscosity. The 5MIN appears to be about twice as thick as the RAE laminating resin and takes about 5 to 10 minutes to cure out hard after mixing. 5MIN is used to locate and fixture parts and must cure out hard. Any tendency to remain soft or "bubblegum" after 1 hour is unacceptable and the material should be replaced.

EPOXY SENSITIVITY

Since last Newsletter, we have had quite a bit of mail from builders who have become sensitized to epoxy. It looks like about 10 to 20% of the builders have some mild form of sensitivity, like Burt does, and about 1 to 2% have indicated a severe reaction. Some have simply had to abandon their projects because of it; others find simple precautions adequate to avoid the allergy. We don't have a "cure-all" for the sensitivity problem but we have had some additional inputs on the subject. We have also changed to a different epoxy formulator, who is now supplying a less toxic material but we don't know if the reduction will be enough to help the severe sensitivity or not.

Epoxy sensitivities seem to be of two basic types; a systemic reaction like an allergy that can be aggravated by breathing the fumes, skin contact with the epoxy, or both; and the second is a "contact dermatitis" or rash which is aggravated by skin contact. Some people have found that an antihistamine like the 'allergy' tablets sold for pollen allergies are effective against epoxy sensitization. As well, one builder sensitive to fumes, found that an activated charcoal filter equipped painting respirator did the trick for him. Another builder is using a "space suit" H.G. Wells thought up.

Some commercial epoxy handling shops prefer to use a disposable plastic glove with a light cotton glove under it. The plastic glove keeps the epoxy off while the cotton allows the hand ventilation and snugs the plastic so that your dexterity isn't impaired. The Ply 9 skin protector is a good barrier, but it can be rubbed off accidentally by working with tools or if your hands sweat or get damp otherwise. Be aware of the limitations of Ply 9 and reapply if you think you have rubbed or washed it off. One physician on our Newsletter list advises

that your clean-up can be just as important as protection beforehand. In the process of washing up, epoxy can be smeared onto unprotected skin, so be sure you wipe away excess epoxy with a paper towel before you start washing, and wash thoroughly.

If you find yourself with an extreme sensitivity you should seek your own doctors advice. Try using all of the normal precautions but for some of you this isn't going to work. It may be that some of you simply can't work around epoxies at all and if that's the case you should probably drop your VariEze project. There is no sense in torturing yourself; building airplanes is supposed to be fun.

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SENSITIVITY QUESTIONNAIRE

(Fill out and send to RAF)

_____Building a____VE____VV____S/N____

Sensitivity ____Mild ____Severe

Describe Reaction_____

_____

_____

Do you use ____Ply 9 ____Gloves ____Nothing ____Other

Did you use any protection when you first started work?____

Have you found a way to work without getting a reaction?___

How?_____

_____

_____

ROLL TRIM

It may be that some builders will find their airplanes far enough out of trim in roll that a fixed ground adjustable roll trim tab may be required in addition to the flight adjustable system shown in the plans. If your airplane requires the additional tab you should install it during your initial runway flying, before first flight. The ground adjustable tab is located on the left wing in the same position spanwise as the plans show for the flight adjustable tab on the right. The tab is .025 aluminum (2024-T3 or 6061-T6), 10 inches long and 2.3 inches wide. The tab is riveted to the wing trailing edge with six 1/8 inch pop rivets. The tab overlaps the trailing edge 1/2 inch as shown and the rivets should be located in the center of the glass to glass overlap. **SKETCHES OMITTED**

Note in the plans changes that the chord of the flight adjustable tab has been reduced to 1.7 inches. The airloads on the 2.3 inch tab were high enough to back it off of the selected position at high speeds. If you have already built the tab, trim it to 1.7 inch chord.

VARIEZE FINISHING

We have seen several examples of excess filling used in the finishing process, particularly over the wing fittings. If proper care has been used in locating the wing fittings only a feathered area around them needs contour microfill. Never stack a lot of fill over the fittings or unnecessarily high in any area (see Section V). The reason for this is not only cost and weight. Having a high separation between the white paint and the glass structure eliminates the flexing compatibility, in that the paint may crack under normal flexing without

glass damage. This flexing compatibility is important since the presence of paint cracks indicates a possible structural problem that requires paint removal and inspection. **SKETCHES OMITTED**

Note that it is better to compromise overall contour than to use excessive fill material.

WORKMANSHIP

In Newsletter #10 we encouraged builders to help "police" each other by being honest with each other and lettin' the guy doing marginal or sub-marginal (junk) work know it. It appears that most builders are doing a good job of building their airplanes but there are a few of you who aren't. We have seen a few examples of workmanship so poor that the parts are structurally unsound and cosmetically wretched. The unfortunate part of it all is that some of these builders either don't know or refuse to admit that they have created junk, not airplanes. It may be a bitter pill to swallow, but some of you will not be capable of building a VariEze. We have found a few builders who try and stretch the limits of our acceptability criteria so they can squeak by with sub-marginal workmanship. The inspection criteria published in Newsletter #10 are minimums for acceptance and they cannot be stretched for your convenience. If you know of someone who is trying to "slide by" with a junk airplane, it is in your own best interest to let him know about it in no uncertain terms. A poor safety record hurts us all. All airplanes are infernally complicated and difficult to build, some are just worse than others. The VariEze is "less worse" than most but some builders will not be capable of mastering it. If you are in this group, be honest with yourself and admit it before your pride gets you killed and puts restrictions on the rest of us. Get some help and get your workmanship up to speed before you continue.

The inspection criteria published in Newsletter #10 were not frivolous standards established to make life hard for the builder. These standards were set up to keep the structure safe and strong. An example of this can be shown in the wrinkle or bump criteria. A bump in the skin tends to trigger a premature buckling failure, and a natural tendency to peel away from the foam core. **SKETCH OMITTED**

The same type of premature skin buckling failure is the result of a dip or impression into the foam. **SKETCH OMITTED**

Keeping the skins straight without humps or dips enables the glass to carry its full load, uniformly supported against buckling by the core. Dips and humps of 1/16 inch or more are structural failures built into the airframe. The key to success is a perfect foam core. Foam core defects not corrected before glassing are the most common cause for scrap parts. Laying up glass over junk just makes it harder and more expensive junk.

VARIEZE QUESTIONS AND ANSWERS

Q. My partner and I plan to do a lot of pattern flying, touch and goes, short passenger flights, etc., in our VariEze, and we don't like the idea of having to switch fuel from mains to the header tank and back for every 15 minute hop. Is it ok if we use the original fuel system shown in Section IIA with the pump?

A. No, the fuel system shown in Newsletter #11 is a mandatory change to the VariEze. The old fuel system was occasionally prone to fuel

foaming in the engine mounted header tank and relied on the fuel boost pump to avoid a possible flame-out. Your concern about having to switch fuel tanks constantly are unfounded. The fuselage tank is rarely selected; the only time it is used is when your flight planning requires long descents with low wing strake fuel (2 gallons per side). The fuselage tank does not even need to be selected for nose down starting. Leave the fuel selector on 'wings' and the fuel in the carburetor float bowl will let the engine run for two

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minutes at idle. The fuselage tank also provides a very accurate indication of your last 2 to 3 gallons of fuel. The accuracy of the system has allowed N4EZ to complete one flight into strong unforecast headwinds with confidence even though the fuel remaining after landing was only 0.3 gallon! In a standard production type airplane the last 0.3 gallon wouldn't even wiggle the gas gauge and an extra stop would have been made, even though unnecessary! If you're shooting touch and goes with under 1/8 fuel in the wings (3 gallon total) you should switch to the fuselage tank. If you do run your wings dry or flame-out in a steep descent with low fuel, you get a re-light in only seconds by selecting the fuselage tank. Putting the below -3 gallon descent starvation in perspective it is helpful to compare it to the average light plane. According to "Aviation Consumer," when a Cessna has an "empty" reading on its fuel gauges it can have from 2 to 9 gallons of fuel! Now, few of us continue to do touch and go's or continue a trip with gauges reading empty. The real beauty of the system is that all the wing fuel can be used in level flight and then have a reliable indication of the remaining 45 minutes of fuel (fuselage). This takes the worry out of using the last few gallons that is present with all other lightplane fuel systems.

Q. I do not speak or read in English. Do you have any plan to offer translations of the plans and instructions into other languages?
A. No, we don't. However, there is a lady in Switzerland who has offered her services. She will translate into German and French for a small fee. Contact Mrs. Dane Rowe, Langgasse 51, CH-3292 Busswil, Switzerland.

Q. If it met reliability and weight requirements, would you accept installation of Rotorways 133 Hp engine (derated to 100 Hp takeoff and 75 Hp cruise)?
A. The engine is like many others, it sounds promising. Only a professionally conducted developmental flight test program can prove the concept good or bad. If the basic engine is proven out successfully then documentation for the operator must be available also so he can operate and maintain the engine properly.

Q. I just finished my wing layup and it took my wife and I all day and half the night. I was so worn out from stippling I couldn't even eat my cookies and milk before bed. What am I doing wrong?
A. Chances are that you are doing a whole group of things inefficiently, not really wrong. First, you are probably short-handed for such a big layup. Those half dozen major layups are kind of like a quilting party, by yourself they are just work, but with a group they can be fast, satisfying and fun. Try to at least get two full time

laminators with an epoxy mixing third. You are probably spending way too much time trying to make the interior glass plies exactly the right epoxy content, stippling your life away. Try making your interior plies extra wet and fast, then spend your time on the final ply with a squeegee and a roller to get the excess epoxy into the top ply or off on the floor. When you have a monster layup to do, take a break every two hours, wash up and put new Ply 9 on, then rest for ten minutes while the ply 9 dries. Be sure you give all your tools a chance to save you work, don't tackle a major layup if you are out of paint roller covers, or without a couple of clean squeegees. Try the kit-supplied squeegee or a softer type cut from a plastic coffee can lid.

Q. The local FAA is really giving me a hard time and it sure would be helpful if they had a set of plans and newsletters. Can you send them a set?
A. No, there are several hundred offices in the U.S. that inspect homebuilts and we couldn't send them all copies; but, for FAA use only you may Xerox copies of the portion you're fighting over. You can copy the newsletters for any reason you like.

Q. I've never cut plexiglass before and I'm getting ready to trim my canopy. Any advice to offer?
A. Yes, get a copy of Cowley's "Care and Feeding of a VariEze Canopy" from Cowley Industries. Every builder ought to read it.

Q. Section IIA calls out #12 wire for the magneto switches. Isn't #18 adequate? #12 is heavy and expensive.
A. Yes, #18 is ok for the mag switches.

Q. Why do you use those tiny little slick tires? How about something with a little tread?
A. Well, tread is hard on props, it tends to pick up rocks and flip them into the prop arc. $$$

Q. To facilitate any rigging adjustments that might be required after my initial test hops I'm going to leave the side consoles off of the airplane until it's flown. Is this ok?
A. No! The pitch control stops are provided by the console and the side stick controller can be easily over-powered (pilot induced oscillations) unless the pilot has an armrest. Don't try to fly your airplane until you finish building it!

Q. Will anyone be offering a "check out" or at least a back seat ride in a VariEze for other builders to get the "sight picture" before flying their own bird?
A. As far as we know, no one plans to do this commercially. You may find other builders willing to give you a ride but I wouldn't expect to fly their airplane yourself. Keep yourself current, practice the initial test sequence in an airplane you are already proficient in, and then take your initial flight testing slow and easy.

Q. My VariEze will never have a pilot other than myself and I'm a 60,000 hour super jock who can handle anything, even blindfolded. Is it ok for me to keep my Eze simple and delete the spoiler mod in CP #11?
A. No, if we didn't feel that the spoilers were required, we wouldn't have made them a mandatory change.

Q. I mislocated my canard lift tab insert and nut plates too far inboard so I remade my lift tab as shown. Do you approve of my fix?
SKETCH OMITTED
A. No! Great Zot, reconfiguring the lift tab as you have done, puts about three times the normal load on one bolt.

Q. I like the smoother surface that I get using peel ply. Can I peel ply my whole airplane outside, saving the sanding in prep for micro and featherfil, and use less featherfil to fill the glass weave?
A. I suppose that you could do this, but it also sounds like a lot of extra work and expense. The peel ply costs $1.60 per yard and the extra epoxy to wet it out is expensive too. This approach might save the light sanding done in prep for micro and featherfill, but you would have to wet out an additional 200 sq. ft. or so of the cloth! Don't confuse finishing prep sanding with structural bonding prep sanding; they are greatly different.

HINTS FOR EZE BUILDING
-A paper cutter is excellent for cutting the zillions of little squares of glass cloth used in the wings and center spar. It even measures.

-Clamping a board on each side of the wing attach fitting while making the bearing pad layups allows you to stipple actively and keeps the glass from squeezing out over the edges. Scissors trimming in this area can be a challenge.

-Canopy. If you move the canopy forward as mentioned in Newsletter #11, be sure that you leave the cut between front cover and canopy in the same place as shown on Page 22-4. The front cover is required for the torsional rigidity of the fuselage. If the vent is too cramped to fit between the plexiglass and the edge on centerline, move it off center.

-Leading edge overlap on wings, canard, and winglets, can be done with ease and very neatly using the paint roller. As you layup the upper skin plies, use the roller to wrap the overlap up onto the bottom skin instead of stippling with a brush. The brush tends to fray the cloth as you stipple giving the cured overlap a very rough surface requiring ambitious sanding to fair. The roller leaves the cloth smooth and unfrazzled. Scissor trim each successive skin ply a bit shorter than the preceding ply giving the lap joint a semi-tapered finish requiring far less work to sand smooth, and eliminating any tendency for the plies to pull away before cure.

-Trailing edges. When making your final inspection and preparation of the foam core for skinning, look carefully for potential trouble spots. A hot-wiring defect or too abrupt curvature may tend to leave voids in the trailing edge corners between the glass and foam. If you even suspect the possibility, sand the area to a more gradual transition before laminating. A well prepped foam core makes the layup much easier.

-Throttle and mixture return springs. Section IIA calls for Century C-161 springs to be used but some builders have had trouble finding them. If you have to substitute some other spring, it should have an unstretched length of about two inches and a force gradient of about 1/2 pound per inch. Adjust for a light but positive return of the arm.

-Paint rollers. These are two rollers found in hardware stores that are excellent for laminating. A nylon, EZ Paintr, No. 9FB.99 for enamel and gloss paints on smooth surfaces. Also, Cov-A-Roll, r-33M, 5/16 inch pile mohair, by Hansteck Corp., Roanoke, Va. Also for enamel on smooth surfaces.

-Hot wire cutting. A good method to use for judging wire temperature is the cut foam surface appearance. A cratered or rutted surface indicates that the wire is too hot. A very light "hair" of plastic strands on the surface is just right.

-Builders have found that the Allen cap screws holding Rosenhan brake discs to the wheel interfere with the glass main gear leg. You can add a 1/8-inch thick aluminum spacer between the gear strut and axle to correct this or make some special flush screws like the one sketched below. **SKETCH OMITTED**

-Be sure to use Teflon tape to seal the threads of all brake line fittings.

-A soldering gun with a 1/16 inch diameter music wire tip can be handy for carving notches into blue foam. The canard red foam inserts and the rudder cable groove in the wing can be done this way.

-Peel coat should be used anywhere possible. Avoid the hard sanding of cured glass by thinking ahead and laminating a peel ply in before you quit a layup. The peel ply will help avoid the damage possible with sanding. It is ok to sand a peeled surface before glassing and it is much easier than sanding non peel plied glass. See Newsletter No 11. We have found that many builders are not using peel ply where they should. Do use it for all areas requiring a glass layup over cured glass surface, ie.

All leading and trailing edges
Outer 18 inches of wing and lower 15 inches of winglet
Front and aft faces of center section spar
All edges of all bulkheads
Fuselage sides where they join nose, cowling, bulkheads and fuel tanks
Faces of canard and wing shear web that join spar caps

-Some component weights were given in Newsletter #10. Additional ones are

Center section spar (Chapter 8) 21 lbs

Wing/winglet/rudder (Chapter 24) 41 lbs

-Carving the nose. One builder found that a black string (weighted with a nut on each end) draped spanwise over the nose helped him to visualize the contour better.

-Nat Puffer has a good solution for raising the height of his Rosenhan master cylinders. It's a simple internal thread/external thread spacer with a cross-section that looks like this sketch. (See photo - pg 14.) **SKETCH OMITTED**

-Nose gear. The cutout in F-22 which allows NG 10 and NG 11 to pass through looks like this: **SKETCH OMITTED**

If NG 11 is trimmed as shown the slot looks like the second sketch. **SKETCH OMITTED**

-Hot wiring. Some builders are finding it easier to get good straight leading edges by adding a small wire to each template at the leading edge as shown in this sketch. Instead of cutting all at once you make two cuts from the leading edge aft towards the trailing edge, one top and one bottom. You heat the cutting wire, burn into the foam and rest 1/4 inch from the template on your guide wire, heat the cutting wire for a two count, burn into the template, pause a two count and then go. The first pause gives your partner time to get into the foam because sometimes the distance is uneven. Cutting foam cools the wire therefore the pause at the template. If you were talking the wire around it would go like this: Heating up, burning in, 1/4 inch away on the wire, one-two, go, template 1-2, go, then count the normal numbers. (Renumber if you want but be sure they match on all the templates) It really helps if you say quarter, half, three-quarters when you have a long way between marks on your templates. **SKETCH OMITTED**

-Nat Puffer suggests using two carpenter's squares and two plumb lines simultaneously to set the landing gear position on the fuselage. **SKETCH OMITTED**

-Main gear toe-in check. An alternate method for checking the toe-in is shown in the sketch. With the axles installed on the gear leg temporarily (clamp), with the airplane level project the centerline onto a wall about 15 feet away. Attach a 4 inch piece of small I.D. tube to the axle mounting faces (5 min or tape) and level them. Use the tubes as a boresight to locate the projection of the axle face on the wall for each axle. Measure X, Y and Z as shown. Z1 and Z2 must be equal. Dimensions Z1 and Z2 must never be greater than the dimension Y (toe-out). **SKETCH OMITTED**

-Layups. Taking a lot longer than the plans call for? Try making your layups purposely wet, then use your squeegee to remove the excess. This method is a bit wasteful but goes much quicker.

-Elevons. A lot of builders ask about elevon dimensions and which ones are critical. Use the dimensions shown here. **SKETCH OMITTED**

-Wing and canard incidence blocks. After glassing the top side of wing or canard and before removing it from the jig (root and tip W.L. still level), Bondo a board to the top surface at mid-span which is also leveled. This board can then be used as an incidence reference which is firmly attached to the surface and isn't subject to errors in positioning each time it is used. The board remains on the surface

throughout the construction of the airplane and is removed just before finishing. **SKETCH OMITTED**

-Flox corner preparation. Try using a wood chisel with sand paper wrapped over the blade for a sanding tool. **SKETCH OMITTED**

-Winglet jig. Several builders have reported good success using the foam block left after hot wire cutting as a glassing jig for the winglet. An inch or two is trimmed off of the leftover block near the leading edge and it is 5 minute epoxied to the work bench to provide a straight custom fitting jig. **SKETCH OMITTED**

-Foam core alignment. To help realign the foam core pieces of the wing and canard for correct spar notch depth, etc., one builder drilled several holes for 3/16-inch dowel rod into the foam block before hot wiring as shown. After cutting, the sections of foam can be assembled on short dowels to aid in jigging for the spar and skin layups. **SKETCH OMITTED**

Some of the problems in foam core jigging are the result of sloppy hot wire cutting. Be sure not to rush the wire around the corners of the spar trough. Pause and move simultaneously at the bottom and top of each trough joggle.

-Foam core assembly. To avoid any gaps or heavy micro joints some builders have been spring-loading the foam cores together chordwise until the micro cures. They use a motorcycle bungee cord, twine, and some cardboard to avoid gouging the foam. **SKETCH OMITTED**

If it is apparent during trial fit that you are going to have a gap, fit a foam piece to fill it, not excess epoxy/micro.

-Spoilers. A couple of builders have reported that their spoiler torque tubes interfere with the brake master cylinders. If you run into this problem, the top of the master cylinder can be shifted aft (away from firewall) by redrilling the brake actuating arm as shown. **SKETCH OMITTED**

-Check the zero position of your elevons when using the templates to measure elevon deflection. The drawings on pages 14-3, 5-7, and 5-6 show the elevon in the neutral (zero) position. Use jig block B (pg 5-6) on the bottom to verify the zero indication of the page 5-7 template.

-Radio support. If you are installing a little one and one/half NAV/COM radio like the Alpha 200, Escort 110, or RT 553, as shown on the instrument panel drawing (A1), an undefined support bracket is required. The radio comes with a mounting tray designed to attach to the instrument panel. On N4EZ we decided to add a pair of aluminum straps from the front cover (forward of canopy) down to the radio tray for better support on the most forward (away from cockpit) end. The brackets are .025 thick and 2024-T3 sheet metal, installed as shown here. To clear the elevon tubes and push-rods, the radio must be angled down about one inch and inboard 1/2 inch from being perpendicular to the instrument panel. Be sure that the control system does not bind on the radio! The angles between radio and instrument

panel are small and not objectionable esthetically. **SKETCHES OMITTED**

-The most important inspection time on any part is immediately after you're done laying it up. This is the time in which you should get a good hand held light (trouble light or any 60 to 100 watt lamp) and walk around your wet layup looking very closely at each square inch for areas of voids, dryness, air bubbles, delaminations, excess epoxy, fiber disruption, etc. Hold that light at various angles to the surface-reflecting the light will help you see otherwise invisible flaws.

Take a brush and some epoxy with you to stipple out flaws. Don't try to inspect a wet layup by yourself, particularly if you don't have sharp vision. If you have made a layup alone, get someone else to look it over closely before you leave it to cure. Your spouse can generally find the flaws on a part that you have overlooked. Most of the unacceptable parts that we have seen were done by a builder working alone and most could have been easily brought up to standards during a thorough post-laminating inspection. Get someone to help you inspect while the layup is still wet, repair it while you can, and avoid making something you must throw away later.

-We have seen one set of wings and canard that the builder knife trimmed 1/2 inch too short. The builder ignored the trailing edge trim line (foam edge), lopping the entire glass-to-glass joint area off. The shape of the canard slot lip and the wing trailing edges were completely ruined. Be sure that you have trimmed at the trim lines shown on the templates and that your trailing edge joints are similar to those shown in the section views in the plans. Check your completed shape and chord length by setting a template on your canard and wing. Do not compromise the length and quality of the trailing edge overlap.

-Your epoxy balance must be absolutely friction-free. Use small nails in the metal tubes for both pivots.

EQUIPMENT MOUNTING NO-NOS
Every homebuilder likes to personalize his airplane and give it his own distinct cockpit appointments. This is natural and every VariEze shouldn't be a duplicate of N4EZ, however, when you try attaching things to the glass/foam/glass sandwich panel you can run into problems. You can't just put screws or rivets into the inside glass skins to mount extra equipment. Mounting to the inside skin alone will tend to peel the glass skin away from the foam core, destroying the stiffness of that panel leading to further flexing and degradation of the foam core and outside skin.

VARIEZE PLANS CHANGES AND ADDITIONS

Section I

Page	Change
6-21	2.3 inch dimension should be 1.7 inch
7-2	Section C-C shows 2-2 with two 1/2 inch

	diameter holes (not 3 pieces!). It should show only one.
Section I Page 4-8	Change 3 hour to 4 hour on skin layup time.
Section IIA Page	Change
2 of 37	4 each Century Spring #C-161 are required, not 3 as shown. 12 gauge non-shielded airframe wire (30 feet) should be 18 gauge (optional change).
4 of 37	Magneto wiring diagram #12 or #14 wire should be #16 or #18 (optional change).
14 of 37	Top view of right exhaust system. Flanges are shown with stud hole rotated clockwise 20 degrees. They should be rotated counter clockwise 20 degrees from spanwise reference. **SKETCHES OMITTED**
Newsletter #11 Page	Change
A1	Materials list for spoilers. 7 x 4 .063 aluminum should be 17 x 4.
Section VI Page	Change
Two	LB 10 The "ear" which joins LB 10 to the helper/snubber springs must be 1/2 inch longer to avoid interference with LB 3 during operation. **SKETCH OMITTED**
Owners Manual Page 36	Add the following statement "Before conducting the tests on this page with your new VariEze, do all of them first with two different airplanes in which you are proficient, ie. a Cub and a Cherokee. These maneuvers (nose wheel liftoffs and runway flying at low power) are a little strange to the average pilot. Doing them in a familiar airplane takes the strangeness out of the maneuver and better prepares you to do them in a new airplane. It also gives you a first hand look at runway length requirements and weather conditions. These maneuvers are important to determine the trim of your aircraft before first flight. Do not ignore them."

Owners Manual Page 5	Delete references to 500-5 and 4:10-3.50-5 tires and add the statement "larger tires are prohibited."
Owners Manual page 30	Under 'Main Gear', add tire inflation pressure 55 PSI. Low tire pressure can lead to tube pinching or tire failure.
Owners Manual Page 28	Revise the allowable weight and Cg diagram as shown below. Note that this provides a 1/2 inch restriction in the forward cg and moves the first flight box back 1/2 inch. This change is not done for the normal reasons to restrict forward cg (flare capability in-ground-effect or takeoff rotation speed). The restriction is due instead to the tendency for the down-going elevon to stall at large aileron inputs, (see Newsletter #11 under "Spoilers") a characteristic which increases at forward cg. **GRAPH OMITTED**
Section III materials list	Switch type V3JV7 should be V3-1001JV7

FLIGHT TEST DATA
This chart is a plot of engine (propeller) speed in level flight at various airspeeds. The data is from N4EZ without wheel pants at a density altitude of 9000 ft. **GRAPH OMITTED**

VARIEZE PERFORMANCE
The following data are the average performance obtained on the last several long trips with N4EZ. It is generally cruised at 60 to 65% power near 10,000 feet and still does not have wheel pants.

cruise speed block-to-block = 179 mph (156 kt)
cruise fuel flow = 5.5 gal/hr (33 lb/hr)
miles per gallon = 32.5 sm (28.4 km)

VARIEZE ALTERNATE ENGINES
Development work is still continuing on the Lycoming 0-235, Honda Civic, and VW engines for possible acceptance for VariEze use. Insufficient data are available to make any conclusions at this time. It is likely that we will have some concrete information by newsletter 13.

VARIVIGGEN ACCIDENT On 21 February 1977 Jim Cavis was seriously injured and the forward portion of his VariViggen destroyed when it crashed during taxi tests. The exact cause of the accident is not completely understood, however a description of it and our impression of what might be done to prevent reoccurrence is presented in the following:

First, a description of Jim's VariViggen - it has a 180-hp Lycoming engine with a fixed-pitch 69x69 wood prop, composite rudders, and standard-outboard-wing-panel shape, built from composite construction (structurally similar to the SP wing). It used a two-piece canopy (windshield and canopy "A" being one piece) and did not have the rollover structure (chapter 11).

Burt Rutan was on his way home from the Denver workshop in the VariEze, stopped by to assist Jim in his preparation for tests, and was present at the time of the accident. Inspection of the airplane prior to taxi testing revealed the following: the left vertical fin had a washout of about two degrees at the tip, such that right rudder would be required to trim the airplane directionally. The main wheels were located at F.S.=132.8, rather than at approximately 130. The initial weight and balance indicated a tail heavy condition, which was corrected by bolting 33 pounds of lead to the F20 bulkhead, bringing the cg for a 185-lb pilot into the aft portion of the allowable cg range for first flight (20 gal fuel). A custom electric actuator was used to actuate reflex control. Reflex travel was not accurately measured, however it appeared that the reflex authority was greater than the specified two-inch motion. Control rigging appeared to be satisfactory.

The aircraft was assembled at the Falcon airport at Scottsdale, Arizona for taxi tests the morning of the 21st. Initial low speed taxi tests were conducted without problems except for poor brake effectiveness which was corrected. Several hours were spent doing low and medium speed taxi runs, checking systems, etc. During one of the initial low speed taxi runs it was noted that there was an apparent binding or jamming of the aileron control. This apparent hangup disappeared. A complete inspection of the control system revealed nothing and the binding did not reoccur. Ground cooling on the 180-hp engine was satisfactory.

Since Burt had considerable VariViggen time, it was decided that he do the initial high-speed taxi tests. He conducted the following highspeed runs on the 4300-ft runway 22:

1. The airplane was accelerated to 45 mph, power was then reduced to idle and during rollout the stick was pulled full aft which rotated the nose wheel slightly off the ground. The nose came back down as the airplane decelerated. Right rudder and brake were required during the acceleration to maintain heading. Reflex was full up.

2. The airplane was accelerated to about 50 to 55 mph, power was then reduced to idle and the stick was brought back to rotate the nose. The nose rotated and was maintained about one to two feet off the ground using a stick position of about half-way from neutral to full aft. At about 40 mph the nose came down. Again it was noted that some right rudder was being used and pitch control felt correct. Reflex was full up.

3. The airplane was accelerated to 65 mph and power was reduced to about 1/4-throttle. When it was noted that speed was constant, the stick was brought aft to rotate the nose high enough so the airplane was light on the mains. The airplane felt in good trim so the nose was rotated further and the airplane lifted off in level flight. The airplane was flown about 600-800 feet down the runway at a height of

one to three feet. Power was smoothly reduced to idle and an uneventful landing and rollout made. Aileron control seemed in trim during the flight (stick centered). Some right rudder was required, and it was noted that after reducing power to idle the stick was nearly full forward to trim the airplane at 65 mph. Trim change due to power at low speeds is normally high (see "VariViggen Owners Manual") however the up reflex authority of this airplane seemed a bit too much, so the reflex was run down about one to two degrees for the next run.

4. Object of this run was to determine a nosewheel rotation speed for full power and to make another runway flight. Full power was applied and maintained until the aircraft was airborne, then smoothly reduced to idle during the flight. The nose rotated at 65 mph, the airplane flew about 1000 ft at about 5-ft altitude and made a smooth, normal landing and rollout. The airplane seemed well in trim except for the requirement for a bit of right rudder. Reflex position appeared to be satisfactory and adequate for the first real flight. During the short runway flight the wings were rocked to check aileron response. Nosewheel rotation speed was normal for full power.

5. Run four was repeated with identical results.

Burt taxied the airplane back to midfield and commented that the airplane flew well and that he felt it would be ready for its first real flight the next day, after installing a small trim tab on the vertical fin to correct the left yaw trim. Jim got in the airplane to taxi it back to the hangar, but then decided instead to do a couple more medium-speed taxi runs and mentioned that he might try a nose wheel lift off. Burt told him that at idle the nose could be raised at 45 to 50 mph and cautioned him to stay below 50. Jim felt that his current flight proficiency was low.

Jim made a taxi run at about 40 mph, then another in which he reduced power at about 50 mph and raised the nose wheel. The nose wheel was about one to two feet off the ground for a ground roll of about 400-500 feet. Taxiing back, he did not stop at the observers to discuss his run. We assumed that his intentions were only to repeat his nose wheel lift off. On the next run he maintained power on acceleration until a higher speed was reached, approximately 60 mph. He reduced power, but only to about 1/3-throttle. He rotated the nose and rolled about 400 feet with the nose wheel off the ground. He then reduced power, the nose came up a bit and the airplane became airborne. The airplane then flew about 600 feet, wings level, and climbed to about 10-feet height. Power was observed to increase, then abruptly go to idle. The nose then pitched up some more and the airplane rolled to the right, striking the right wing tip on the ground immediately off the runway. Next ground contact was the right canard, then the airplane's nose and canopy as it rolled further right to a nearly inverted position. It slid 60 feet to rest, in a heading 45 degrees to the right of runway heading.

Jim received a very serious head injury and a broken wrist. At this writing his condition was improving but not yet to the extent that he could recall any details about the accident. It is not known whether he had intended to make a lift off or to merely raise the nose.

The entire forward fuselage forward of F.S.90 and the right canard was broken up. The fiberglass pieces (nose cone and visor) are intact, but the majority of the wood fuselage structure was destroyed. The fuselage fuel tank was crushed about 10" and leaked in one corner; there was no fire. The engine, engine mount, and all components in the engine area remained

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intact, inplace, and undamaged. Both vertical fins were undamaged with the exception of the top front corner of the right fin. The entire inboard wing, main landing gear, and left outboard wing were undamaged. The composite right wing's foam core was shattered from the tip inboard about 2-1/2 feet. The glass skins were intact. The right outboard wing, including attachment was undamaged inboard of a location three feet from the wing tip.

A description of what happened is easy. An analysis of why it happened is not. The airplane's motions in pitch are explainable and understood. The reason the airplane rolled to the right is not known; we can only speculate. We do not believe Jim was intending to lift off, and thus was surprised and shocked to find himself airborne. After the short flight had progressed in an accelerating and climbing fashion he probably realized that the end of the runway was quickly approaching and thus slammed the throttle to idle. At that point he still had 2400 feet of runway left, but at ten feet altitude and climbing, we're sure the runway looked quite short to him. It did not appear that he countered the airplane's natural nose-up trim change when power was reduced, but that is only speculation.

Why did the airplane roll? Could it be the airplane stalled and thus dropped a wing? Possibly, but this is not likely since the angle of attack did not look excessive and N27VV, the VariViggen prototype, shows no tendency to drop a wing during stalls, even at idle power. Could the controls have failed or jammed? Inspection of the wreckage showed all controls intact. The nicopress sleeves on the roll cables passed within 3/8" of a rib and the cable ends were frayed such that this may have hung up the controls. This, however, seems unlikely; a similar rigging exists on N27VV and no jamming has been noted in over 600 hours of flying. Possibly Jim was disoriented due to the shock of the unexpected flight and nose-up trim change such that he was unable to control the airplane. Possibly he was partially blinded by the sun which was just above the horizon directly in front of him. The airplane's out-of-trim condition would have had a tendency to make it turn left, not right, so that seems to have no bearing on the cause of the right roll.

Now, what can you, as a VariViggen builder do to prevent reoccurrence of this tragedy when you conduct initial tests of your airplane? The following procedures should be followed. You will note that they are essentially the same information that is in your owners manual, with added emphasis.

Airplane Preparation

Be sure your weight and balance is conducted accurately. Your calculated cg with the pilot should be checked by weighing the airplane with the pilot on board. Cg should definitely be within the first-flight box, preferably at F.S.122. Check control surface travel: elevator 29 degrees down, 10 degrees up minimum; rudder 29 degrees outboard, 11 degrees inboard +-3 degrees. Set reflex position to obtain the neutral position of the ailerons as shown. This is approximately mid-reflex. Use this reflex position for your initial tests. True, a lower rotation speed can be obtained with up reflex, but using mid-reflex will assure that you have ample elevator control authority even if you have errors in construction, such as incorrect canard incidence, warped wing, etc. **SKETCH OMITTED**

Maximum aileron travel about this neutral position is not as important, should be approximately +-10 to +-12 degrees.

Pilot Preparation

There is no such thing as a minimum number of hours a pilot should have to be qualified for initial test flying. The best pilot qualification is variety. He should be current in more than one type of airplane. The VariViggen is not difficult to fly, but it is different; like a Yankee is different from a Cessna, or a Cub is different from a Cherokee. A pilot who is used to the differences between a Cessna and a Cub, is ready to adapt to the differences in a VariViggen. So, get some current time in a variety of airplanes. Also, shortly before you do your high speed taxi tests and lift offs, do those tests with another airplane. Doing a nosewheel rotation with idle power, doing a short hop down the runway at one to three-feet altitude, etc., is something a little strange to the average pilot. Doing a few of these in a Cherokee or Yankee takes the strangeness out of these maneuvers in a familiar airplane and better prepares you to do them in a new airplane. It also gives you a first-hand look at runway length requirements, weather conditions, etc. Do wear a helmet and shoulder harness for your initial tests. Jim's injuries would have been far less severe had he been wearing a helmet.

Test Procedure

Follow carefully the ground tests and high speed taxi procedure in the VariViggen owners manual. Be sure to reduce power to a low setting or to idle to avoid accelerating to a higher speed when you do the nose wheel lift-offs. Use the mid-reflex position shown above.

Follow the lift-off procedure shown in the owners manual, using mid-reflex. Before lift-off be sure to reduce power sufficiently to avoid accelerating, and above all, make power adjustments slowly and smoothly. The only unusual thing about the way a VariViggen flies is the trim change due to a power change at low speed. This is quite easy to get used to, if power adjustments are made slowly. After you have several hours in the airplane you will find that countering the trim change is not difficult even for rapid power changes.

Follow the first flight procedure in the owners manual using mid-reflex. The prototype, N27VV has satisfactory pitch control authority throughout the entire eight-degree reflex range. However, due to tolerances/inaccuracies in construction you may find that your airplane

is different; for example, at aft cg, up reflex, and idle power, your stick-forward (down) control may be limited and thus you should limit up reflex travel, or conversely, at forward cg, down reflex, and full power, your stick-aft (up) control may be limited at low speed. Thus, you should rig your airplane to limit down reflex travel. So, follow the envelope expansion section of your owners manual carefully. Make cg changes and reflex changes a little at a time and evaluate all conditions of speed and power (at altitude) before further changes. Thus, if your airplane is rigged or built differently than N27VV, you can safely determine a comfortable cg range and reflex authority for your airplane. Once this is determined be sure to placard your aircraft, limiting pilot weights to remain within the allowable cg range. Set the reflex stops to limit its authority to the range which you are comfortable with.

We are making the prototype N27VV available to VariViggen builders who have completed their airplanes so that they can get a frontseat checkout. Those of you who have a VariViggen nearly completed and have good current pilot proficiency are encouraged to get some dual in N27VV before conducting your flight tests.

VARIVIGGEN PLANS CHANGES AND ADDITIONS

Owners Manual	Add the information from "VariViggen Accident" to your Owners Manual.
SP Wing Plans Clarification	The drawings do not show the inboard glass rib which is discussed in the text. The sketch below gives the general arrangement. **SKETCH OMITTED** The trailing edge of the SP wing has a kink in it at the outboard end of the aileron. This is normal and due to the change in taper and sweep which occurs at this butt line.

SHOPPING

WANTED
Steven Sterner, 317 S. Washington Ave., Sabetha, Kansas 66534 is interested in buying a partially complete VariViggen project.

Buyers Beware
The Anderson Engineering Co., Florrissant, Mo. has been dragging out deliveries of hot wire controls excessively. Better look elsewhere.

FOR SALE
1 run out C-85 Continental, $350. Call Dave Bassett 503-378-8227 (work) or 503-476-2021 (evenings).

Epoxy ratio pumps. Gougeon Bros. has announced an improved version of their "mini" pumps which is made of a more expensive, but inert, plastic. The new "super mini" pumps sell for $9 a set.

Fuel strakes. Jiran is now offering prefab composite wing strake fuel tanks. These are very nice looking parts and they add about 4 gallons to the total fuel capacity.

DISTRIBUTORS REPORT

JIRAN:	F.J.G.R. reports that they are meeting the main gear shipping schedule published in their most recent letter. The engine cowlings are now off-the-shelf item with no shipping delay. Canopy frames and mounted canopies are also very close to being backlog free. Jiran is now producing wingstrake/fuel tanks and these are very handsome parts. The molded, vacuum laminated parts are a tad lighter and hold about 4 gallons more fuel than the plans Chapter 22 tanks.
BROCK:	Ken reports that wing fittings, one of the big delay items, are now caught up to orders placed through February '77. All of the other parts appear to be moving along steadily. Ken and his troops are now producing the bulk of the landing brake parts and spoiler system parts, but they haven't gotten into his catalog yet. Ken reports that he will have a catalog addition out soon and it will include price and availability of the raw unmachined aluminum castings.
AIRCRAFT: SPRUCE & WICKS ORGAN	It looks like the backlog of orders, and the wait for materials, has finally calmed down. New kit orders are now being shipped within 3 to 4 weeks. Some minor items, like wheels and brakes, still seem to be coming in later than the bulk of materials, but the backlog on these items is disappearing fast now that the manufacturers are on line.
COWLEY ENTERPRISES:	Canopies are basically off the shelf, immediate shipment items.

Cowley's have opened a facility on the Mojave airport. The address at Mojave is Building 170, Mojave Airport, Mojave, CA 93501.
Note that there is now a source for Vari Viggen canopies - check the distributors list included with this newsletter.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Another method to aid in main gear alignment. Note the use of string to hold strut in place.

Nat Puffer's landing gear alignment.

Squadron One's meeting at Ed & Jo Hamlin's house.

Main gear struts await inspection at Jirans.

Jo & Ed Hamlin of Squadron One (see Newsletter #11) with their EZ.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

VARIVIGGEN PHOTOS

Charles Allen's forward fuselage.

Ulrich Reifenstein is building a VariViggen in West Germany. His excellent metal parts are shown below.

Fred Sumida is installing a 4-piece canopy and has assembled his inboard wing off the fuselage.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Buddy Cottle's N13CF 3 months after starting project.

Dr. J. R. Wright's winglet showing rudder attach details.

Nat Puffer's fuselage with the nose gear box installed.

Hanger Flyin' in Sacramento at the "RAF Squadron one" meeting in March.

C.E. Prophet & friend.

Nat Puffer's firewall. Notice the master cylinder extension.

Jim Boyd's daughter says she's the only girl in her second grade class who can stipple!

Dr. Wright laying up his canard shear web.

Mr. Cassity is extremely sensitive to epoxy so he built this rig. Looks like 2001!

Peter Krauss' airplane with a +5G static load. In West Germany this test was required by the L.B.A. (FAA).

Peter Krauss and his crew of helpers. It takes a lot of muscle to load sandbags.

Krauss' initial taxi tests with a Limbach VW conversion. He has since converted the airplane to Continental.

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BELOW IS VARIEZE SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIEZE TWO-PLACE SPORTPLANE

**PHOTOS OMITTED

THE STORY
For the last 12 months, we have refrained from promotional activities and marketing on the VariEze to concentrate totally on its development and setting up materials and components distribution. In this short time, we have 1. flown a full 350 flight-hour test program on two prototypes, one Continental and one VW-powered, 2. completed full structural qualification testing, 3. prepared a manual for the amateur builder to educate him in the structural materials and to guide him through construction, 4. set up a materials distribution system through established, competent distributors.

THE TEST PROGRAM
The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE RESULTS
The VariEze has superb flying qualities for its primary mission - comfortable travel. It has excellent hands-off stability even in turbulence. It is unusually safe at low speeds, can be flown with full aft stick (47 kt) without being susceptible to departure or spin, regardless of attitude or power. Performance is also superb - cruise up to 200 mph and climb up to 1700 fpm at gross weight with the larger engines.

THE MISSION: PRACTICAL UTILITY
Although quite compact outside, the VariEze provides unusual comfort for up to 6-ft, 7-in, 210-lb pilots and 6-ft, 5-in, 220-lb passengers, plus two medium-size suitcases and four small baggage areas. The 24-gallon fuel load allows up to 1000-mile range at economy cruise. High altitude climb is excellent, for flying over turbulence, mountain ranges, and for satisfactory high-density altitude take offs.

THE DESIGN
The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic systems design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE STRUCTURE
New composite sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, longer life, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair.

THE HOMEBUILDER SUPPORT
The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter,

"The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations. Construction seminars are provided at RAF and elsewhere.

THE AVAILABLE HOMEBUILT
Established, competent distributors have stocked materials and components before the aircraft was marketed. All raw materials are now available plus many prefabricated items including canopy, landing gear, wing quick-disconnect fittings, cowling, all machined items, rudder pedals, engine mounts, suitcases and upholstery. If you choose to purchase all prefab parts, you can build your VariEze in about 500 man-hours - really!

VariEze documentation is available in five sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full-size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words! The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, A75, C85, C90, 0-200
SECTION IIB - VW engines (avail. Oct '76)

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system, avionics, landing and position lights, antennas, starter. Avail Sept. 76

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim. Avail Sept 76

Specs & performance with 100-hp Continental.fixed-pitch prop.@ gross weight

Take Off	800 ft
Climb	1700 fpm
Max Cruise	200 mph
Econ Cruise	165 mph
Range @ Max Cruise	720 mi
Range @ Econ Cruise	980 mi
Min Speed (full aft stick)	49 kt

Landing	900 ft
Canard Span/Area	12.5'/13 square feet
Wing Span/Area	22.2'/53.6 square feet
Empty Weight	520 lb
Gross Weight	1050 lb

Specs & performance with 75-hp Continental

Take Off	950 ft
Climb	950 fpm
Max Cruise	178 mph
Econ Cruise	145 mph
Empty Weight	490 lb
Gross Weight	950 lb

Check items desired:	Price, including First class mail U S and Canada	Air mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher' newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$94.00	$108.00
Section IIA or	$19.00	$21.00
Section IIB		
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00

Calif. residence add 6% tax on all items except newsletter

* U.S. funds only

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft stick	49 mph
	Landing	500 ft
Performance with 150-hp. Special Performance Wings	Climb	1000 fpm
	Cruise	158 mph
Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 square feet
	Wing Span/Area	19 ft/119 square feet
	Empty Weight	950 lb
	Gross Weight	1700 lb

Specifications	Wing Span/Area	23.7 ft/125 square feet
Special Performance Wing	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price: $4.75 per year first class mail, $6.50 air mail overseas. Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing, 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described. Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles. Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price: $4.75 first class mail, $5.50 air mail overseas.

The following are RAF-authorized distributors of materials and components. Items indicated have been developed under RAF approval and are recommended for VariViggen or VariEze aircraft. Contact the distributors at the address shown for his catalog and description of items. Indicate to him that you are a VariViggen or VariEze builder.

Overseas Catalog Orders - Include Airmail Postage PLEASE

AIRCRAFT SPRUCE & SPECIALTY CO.
201 W. Truslow Ave.
Box 424
Fullerton, Ca. 92632
(714) 870-7551

OR

WICKS AIRCRAFT SUPPLY
1100 5th Street
Highland, Il. 62249
(618) 654-2191

Catalog cost $2 - Refundable at first order.

VariEze materials: epoxies, foams, fiberglass, filler materials, wood, metals, all hardware, specialized tools, skin barrier cream, seat belt/shoulder harness sets, wheels & brakes & custom upholstery/suitcases.

VariViggen materials: spruce kit, plywood kit, hardware, aluminum & fiberglass.

KEN BROCK MANUFACTURING Catalog cost $1 - Refundable at
11852 Western Ave. first purchase.
Stanton, Ca. 90680
(714) 898-4366
VariEze prefabricated components: wing attach/quick
disconnect assemblies, nose gear machined parts, control system
components, fuel cap assemblies, welded engine mounts,
welded stick assembly, welded rudder pedals, wheels & brakes.
VariViggen prefabricated components: all machined parts.

FRED JIRAN GLIDER REPAIR Write for brochure.
Building 6, Mojave Airport Send self-addressed
Mojave, Ca. 93501 stamped envelope.
(805) 824-4558
VariEze prefabricated components: Molded S-glass main gear
and nose gear struts, nose gear strut cover, nose gear box.

COWLEY ENTERPRISES Write for brochure.
P.O. Box 14
Santa Paula, Ca. 93060
(805) 525-5829
VariEze plexiglass canopy - Light bronze tint or clear.

H. C. COMMUNICATIONS Write for brochure.
Box 2047
Canoga Park, Ca. 91306
VariEze and VariViggen custom COM & NAV VHF antennaes.

THE AIRPLANE FACTORY Write for brochure
7111-A Brandtvista Ave on Viggen canopy
Dayton, OH 45424
Vari Eze - None
Vari Viggen - Plexiglass canopy

MONNETT EXPERIMENTAL AIRCRAFT, INC. Ask about VariViggen parts.
955 Grace St.
Elgin, Il. 60120
(312) 741-2223
VariEze - None
VariViggen - All molded fiberglass parts

GOUGEON BROTHERS Write for brochure.
706 Martin St.
Bay City, Mi. 48706
VariEze - None
VariViggen - 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS Contact him for list
4102 Twining
Riverside, Ca. 92509
VariEze - None
VariViggen - welded nose and main landing gear, 1-1/4" sq.
steel tube.

BILL CAMPBELL (VariViggen builder) Contact him for list.
Box 253

Phelan, Ca. 92371
VariEze - None
VariViggen - Prefab brackets and fittings.

JESSE WRIGHT Contact him for list. ($0.50)
7221 S. Colorado Ct.
Littleton, Co. 80122
VariEze - none
VariViggen - prefab wood parts.

FLASH - AILERONS CORRECT VARIEZE ROLL DEFICIENCY
April 16, 77

BACKGROUND - One of the first homebuilt VariEzes to fly was Tony Ebel's. Tony has flown it only once. Tony took off from a runway too short to allow a trim-determining runway flight instead of following the flight manual-recommended procedure. As he climbed and accelerated he found his airplane had a severe left yaw tendency requiring nearly full right rudder to control. He flew the pattern with cross-controls to keep things upright, made his approach and a safe landing. Tony is an experienced Pitts pilot. A less experienced person might not have been as lucky. His airplane has an incorrect washout in one wing and large unsymmetrical discrepancies in the winglet airfoils. While the reason his airplane flew so crooked could have been predicted by measuring his airframe, we were concerned that even though we have repeatedly emphasized the importance of building a straight airframe, some of you may find your first flight as harrowing as Tony did. Knowing that rear wing ailerons have the potential of much higher roll control capability and that they would definitely solve the partial stalling of the down-going elevon, we felt that even a crooked airplane could be safely flown. We decided to develop rear wing ailerons for N4EZ and use the canard controls only for pitch (elevons become elevators).

REAR WING AILERON SYSTEM
Design and construction of the aileron system including manufacturing of all parts and installation in N4EZ required approximately 80 man-hours over a five-day period. Cost of materials was about $45 more than the elevon system. The new system consists of a single pushrod from a modified stick to the canard elevators. The stick mounts on a torque tube extending to the rear seat stick and extends to the firewall (yes, dual controls are not only simple now, but quite practical). Pushrods extend to belcranks near the wing attach fittings and pushrods extend aft to the aileron arms. All controls are within the confines of the cowling; nothing is external. The ailerons extend from the inboard wing rib out to B.L.74. The wing is easily modified, an inside glass layup providing a new aft spar. The spoilers are eliminated.

FLYING QUALITIES IMPROVED & DUAL CONTROLS ADDED
While the roll qualities were improved with the spoilers, the airplane still had a sluggish feel in roll and still had some coupling (pitch inputs when roll was commanded) particularly at forward cg. We have of course been concerned that this deficiency would reflect on the canard

configuration itself, a reputation it does not deserve. The aileron-equipped VariEze now has excellent flying qualities and safety in all respects. Its roll rate is comparable to a Yankee. Its roll rate qualities are superb, with minimal adverse yaw. Its crosswind capability is greatly improved. Its "hands off" stability is retained, and its roll/pitch coupling is gone.

Now for the big question: should you install them on your airplane? We strongly encourage all of you to install the ailerons. Consider them mandatory if you suspect that your aircraft is not built straight, or if your pilot proficiency is not good since they increase roll control and the airplane flies more "conventional." The new flying qualities not only make the airplane safer for crosswinds, but they allow incorporation of a rear-seat stick and throttle for those wanting fly-home-and-land capability in the event of pilot incapacitation.

Flutter and stall tests are now being conducted. Plans for the modified control system are being drawn and will be available by about 7 May 1977. The plans are free, but you are being asked to provide the postage. Plans can be picked up at RAF after 7 May or will be mailed to you if you send us a self-addressed 9" x 12" envelope with 57 cents postage ($1.50 for air mail over seas). PLEASE include your aircraft serial number. Those of you who have just installed spoilers are probably upset & asking "what's next"? We can assure you there will be no further redesign of the control system. We are completely satisfied with it now. Changes cause us considerable hardship too!

THE CANARD PUSHER NO. 13 JULY 77

News of the VariViggen (Very Vig-in) and VariEze (Very Easy)

NEWSLETTER SUBSCRIPTION - $4.75 per year
OVERSEAS (AIRMAIL) - $6.50 per year
BACK ISSUES - $1.00 each

If you are building a VariViggen you must have #1 thru current.
If you are building a VariEze you must have #10 thru current.
The "Canard Pusher" is published quarterly: Jan., Apr., July, and Oct. by

Rutan Aircraft Factory
Bldg. #13, Mojave Airport
Mojave, Ca. 93501
(805) 824-2645

RAF ACTIVITY since the April newsletter has included a complete flight-test program on our new aileron-equipped VariEze, support of builders and flyers of the VariEze and VariViggen, two Mojave flight demo days, VariEze trips to the Chino and Watsonville Flyins, check-outs for some VariViggen builders, further structural research, VariEze flying for a movie project, VariEze evaluations by several aviation writers, and development of a homebuilt homesolar water heater.

Except for the VariEze's exhaust system, both the VariEze and VariViggen have been maintenance free since newsletter 12.

You are invited to visit RAF to inspect our airplanes. If you are building, bring parts from your project so we can help with inspection, etc. Our regular hours are 9 to 5 (with a lunch break), Wednesday through Saturday. Builders who need construction assistance may be able to catch us by phone at other times, but we may be in the shop with epoxy up to our armpits, so try to call Wednesday through Saturday if you can.

HOMEBUILDER FLIGHT REPORTS At last count there were eleven VariEze's and one VariViggen flying (not counting the airplanes at RAF). We understand that Bob Conn flew his VariViggen first flight on May 20, but have little information from him. Bob, how about a report for the next newsletter? You VariEze flyers are also a bit tight on info when you are busy on your flight test programs. The following has been gleaned from letters and calls from those now flying. How about a good report from you guys for the next newsletter. As far as we know all VariEze's that have flown are now in current flying status. Maybe some will have restrictions flown off and will make it to Oshkosh.

Peter Krauss, Stuttgart, Germany - Peter has already flown to at least four airshows in three European countries, including the big Paris airshow. Peter reports his first flight was a bit tricky because even though he felt his airframe was straight, it was out-of-trim enough to require rudder to keep things upright (this was with elevons, of course). Second flight on were okay after installing another roll trim

tab on the wing. Peter has experienced the same exhaust system cracks as on N4EZ (see later in newsletter) and has modified the exhaust system. He has found, as we have, that the Cleveland brakes are more effective than the Rosenhans and result in less runway required for landing. Peter has done a lot of flying in rain with his VariEze and has noted an unusual phenomenon. Due to the difference in airfoils and loadings of the wing and canard the airplane trims nose up when wet in a rain shower. When rain is encountered you have to hold forward stick pressure and this disappears after the airplane dries out in clear air! Now that the Paris airshow is over Peter has brought his airplane back into the shop to install the ailerons. Incidentally, Peter has produced an 8mm sound movie (in German) covering the construction aspects of his VariEze.

Tony Ebel, Lompoc, California, who we reported on in CP 12 as also having a tricky out-of-trim first flight, is now flying again, this time with ailerons. He reports that he really likes the ailerons and finds the pitch control a bit sensitive. He still has a crooked airframe, particularly the winglets, which results in an out-of-trim condition at high speed, but it is easily controlled now with ailerons.

Lee Herron, New Jersey - "VariEze N1WX flew on Sunday, June 18 for one hour and all went very well. We have a heavy right wing--a trim tab on the left wing has corrected it and she now flies hands-off for thirty-minute periods. All in all--thanks for a great aircraft design. She is fast--outruns everything around here and does everything I ask of her. All the Bonanza owners hate her. We now have 17 hours and will see you in Oshkosh shortly." Lee's airplane has ailerons and a Continental C-90 engine. Lee has noted a 1/8 quart oil loss per hour through the breather. I lose about 1/10 quart per hour on N4EZ. I'm going to try to relocate the breather hose to the top of the starter cover plate, since I suspect that the oil loss occurs only during a steep climb. Lee had earlier damaged his airplane when he made a high-speed taxi test without locking the canopy. The canopy blew open and he had a locked brake due to the use of automotive brake fluid. This swells o-rings and ruins brakes. Use only aircraft brake fluid.

Cy Mehling, Pennsylvania - "Be it known that on the evening of 16 June '77 VariEze S/N 3 lifted off the runway at Doylestown, Pa., flew over the surrounding terrain for about one hour and disrupted every household, picnic, graduation exercises, and all other associated activities in this little town as first eyes turned upward, followed by a mass migration to the airport. This morning it's hard to comprehend that just nine months and twenty days ago those big boxes of foam arrived from Aircraft Spruce. Mary and I send our greetings and heartfelt thanks for the many times you have helped us in the past and an astonishing design for our new airplane." Cy's airplane has an O-200 and ailerons.

Wicks Organ Co., Illinois - N101MW is again flying after its layup to install ailerons. George Gibbons made three flights the first day out and reports he likes the flying qualities, except he felt it was a bit sensitive in pitch until he got used to it. George reported that it was a real strange sensation on his initial taxi tests because of the pilots position out in front of the slim cockpit, but this feeling disappeared after being airborne. George also mentioned that although he made good landings, it was difficult to teach himself to "drive it

on" per the Owners Manual instructions, since he had been taught to always make full-stall landings.

Gordon Olsen, Oregon, flew first flights in April. His highly modified VariEze, powered by a Continental C-85 has reflex adjustable ailerons, a modified tapered canard and a novel instrument panel that lifts with the canopy. Gordon is a competent engineer, using his VariEze for some interesting aerodynamic research.

Kibler/Cowley/Kern, California - The Honda-powered VariEze has been out of flight status lately for some engine updates and installation of ailerons.

As I am writing this I received a call from Johnny Murphy, Florida. His C-90 powered VariEze made its first flight today. Johnny was pleased with handling, had good cooling, and made an uneventful landing. He commented that, like George Gibbons, he had made a full-stall landing even though he was aware of the recommendation to drive it on at 60 kt. During this first flight he experienced an engine failure. He switched the fuel valve to the fuselage tank and the engine immediately restarted. He had not yet checked his fuel system to determine the problem, but he suspects that his Bendix-type carb may require a larger fuel lead. He will, of course, recheck his fuel system and he intends to install the Marvel Schevler carb.

To all those flying, our hearty "congratulations." There are few experiences as exciting as first flights in an airplane you have built with your own hands. Add to that the intrigue aroused by watching your unusual shadow cast on the ground, and the ease at which you can out climb your chase plane and this adds up to one very fulfilling experience!

A comment is in order for those who are, or will, experience pitch sensitivity. Over controlling the airplane in pitch is generally due to the pilot forcefully ham-handing the controls because he is apprehensive and is concerned about "getting behind it" on first flight. A side-stick control is set up for lower control forces than a wheel or center stick, because the arm is rested on the armrest and only the wrist action is used to control. Heavy forces are tiring for a wrist control, thus light forces are designed in. However, if you are flying with your arm off the armrest and using your arm muscles to control the stick, the forces will feel too light. The airplane has excellent damping and stability with hands-off controls. So, rest your forearm on the armrest, use smooth wrist action for control and above all, relax. The VariEze flies smoothly by itself. Smoothly steer it where you want it to go, don't force or jam it back and forth. Of course, pitch forces increase at forward cg. If you are uncomfortable with the forces, move the cg forward until your transition is completed. Also, be sure to use cushions as required to place your head up nearly touching the canopy for the best forward visibility.

OSHKOSH 77 The RAF office will be closed from 25 July to 12 August for our annual Oshkosh, Wisconsin trip for the EAA convention. There will be forums on the VariEze at Oshkosh on 31 July and 5 August. A

VariViggen forum will be held on 2 August. Burt Rutan will also give a lecture on flight testing on 4 August. VariEze construction workshops are scheduled for 1 August, 3 August, and 6 August. We will also have our booth open all week--this will be a good place to get your building questions answered since the booth will be manned by active builders. Do bring parts of your project so we can help you with any inspections and better answer your building questions. We should also have a sound movie produced by Ferde Grofe Films. The film shows VariEze, N4EZ, in action, including preflight, taxi, takeoff, mountain flying in some narrow canyons, low-level strafes, landing, etc. Film was shot from the ground, chase car, chase aircraft, and from the VariEze's back seat. Ferde Grofe Films will be marketing the film in Super 8, 16mm, and video cassette for sale and rental. Contact them for price and availability. --18139 West Coastline Drive, Malibu, Ca. 90265.

VARIEZE AILERONS As you know, the VariEze underwent a major control-system design change shortly before newsletter 12. At that time we had made only a few flights with ailerons but were already convinced that they were a very important addition to the airplane. Aileron plans were first available on the first of May and we hope that all serious builders have received them and updated their plans and airplanes to this configuration. If you have plans and do not have the aileron addendum send RAF a 9"x12" envelope with 57 cents postage ($1.50 overseas) and with your address written on the front. Include your aircraft serial number. RAF will stuff your 9 x 12 envelope with the 19-page aileron addendum, thus updating your plans. There is no charge for these.

RAF has gone to considerable expense in developing the aileron system, including (1) a full flight test program revalidating the airplanes performance, flying qualities at all cg's, absence of flutter above the dive speed, absence of spin susceptibility and crosswind capability, (2) preparation of drawings and assuring the availability of parts thru distributors, (3) absorbing some of the loss due to obsoleted items (spoiler parts and VECS 5/6).

Of course, the big question is why, why we waited until this late to remove the roll function from the canard and add ailerons for roll?

The reason we did not originally use conventional ailerons is that we were obsessed with the simplicity and low cost of the elevon control system. We knew that it did not provide optimum flying qualities in that the roll rate was sluggish unless rudder were used, and that large aileron deflections resulted in the elevon being deflected far enough to cause a partial stall on the down-going surface. This produced a mildly objectionable pitchdown when large aileron inputs were used at low speeds, particularly at forward cg. Installation of the small spoilers on the cowl offset this somewhat, but did not cure the cause. We had assumed that these objections were minor enough to accept and that keeping the simple control system was justified. The fact that the airplane required rudder to maneuver well at low speeds was documented in the Owners Manual, including the requirement for good rudder proficiency for the pilot before being qualified to fly the airplane.

We did not consider the sluggish roll rate to be a flight safety consideration, merely a minor objection that the pilot easily gets used

to as he builds his proficiency. Well, to be blunt, the initial homebuilder's experience showed that we were wrong. We found that far too often people just don't do what you tell them to. They don't determine roll trim in a ground-effect flight as the Owners Manual instructs. They fly without roll trim or with a crooked airplane or without the appropriate pilot proficiency. Worse yet, we have found that even small differences in the wing airfoils, winglet angles, or wing twist caused enough out-of-trim that three out of the first six homebuilt VariEzes to fly with elevons found that they had to use rudder just to keep things upright. This being the case, we are forced to make installation of the rear wing ailerons mandatory for everyone.

Now, for the good news. The aileron-equipped VariEze adds some important capabilities to the airplane in addition to its stronger roll authority required to offset an out-of-trim airplane. Returning the strongest roll control to the stick, rather than the rudder pedals made it quite practical to add a rear stick to allow a rear seat passenger to fly home and land in the event of pilot incapacitation. The rear seat stick is included in the aileron plans. The canard control surfaces are now used only for pitch control and thus their effectiveness is not compromised to allow large deflections for roll. As a result, they are much more effective in their role of giving the canard its high lift required at forward cg. Whereas the VariEze used to be limited to pilot weights below 210 lb., the forward limit cg is now extended and pilots weighing up to 255 lb. can be accommodated. The forward cg limit is now based on structural considerations on the nose gear strut; even at forward limit cg of sta 95 the VariEze has more than enough elevator power to rotate the nose before lift-off speed and to flare in-ground-effect.

The aileron-equipped VariEze can now do good conventional sideslips, a maneuver that was very limited with elevons. Sideslips aid forward visibility during steep climbs and greatly increases the airplanes capability to make a good landing in a gusty crosswind.

Most important, the airplane now flies more "conventional", in that roll authority is stronger on the stick rather than the rudder pedals. This should greatly shorten the time required for a pilot to transition to the point where he feels comfortable. We were also concerned that the sluggish roll rate would reflect on the canard configuration in general. A reputation it does not deserve.

Another thing we found through the homebuilders experience was that the spoiler system was unacceptably susceptible to errors in workmanship in installation and rigging. Within the first ten airplanes we inspected we found three who had the spoilers rigged improperly or were rubbing on the cowl! Thus, we were quite pleased to put the entire spoiler system in the trash can where it will never get out of rig or jam on the cowl.

One of the early reasons we were reluctant to incorporate ailerons was our fear of a rear wing flutter mode that may be divergent. This is why we designed the ailerons in the configuration of a full-span mass balance. Flight tests have shown the airplane to be free from flutter. The highest flutter test point was at 240 mph indicated at 10,000 feet, which is a true speed of 280 mph. All controls had deadbeat damping at this speed, thus demonstrating adequate margin over red line speed.

We had previously preached that the "clean wing" of the VariEze (no control surfaces) provided a performance advantage. We were wrong. We have been unable to detect any speed loss due to the installation of the ailerons. In fact, we see a slight increase in corrected performance data, a drag reduction we cannot explain.

In summary, the current configuration (canard elevators for pitch, conventional rear wing ailerons and no spoilers) gives the airplane overall flying qualities we can all be proud of. Roll rate is more rapid than the average light plane, adverse yaw is much less, and flight safety for first-flights/pilot transitions is improved. Those of you who had already fabricated the spoilers and the old configuration stick assembly will have a mild setback in $ and work, but the result is well worth the additional effort. We feel concerned enough about the problems some homebuilders encountered with elevons that we are recommending that inspectors do not approve a VariEze for an airworthiness certificate unless ailerons are installed. The out-of-trim condition on first flight has not yet caused an accident and we want to insure that it never does.

COMPOSITE STRUCTURE DESIGN We receive an occasional question concerning design information and materials properties on composites. An excellent reference is a series of articles written by Hans Neubert and Ralph Kiger published in "Sport Aviation" (EAA) Magazine July 76, Sept. 76, Dec. 76 and April 77.

VARIEZE ELECTRICAL SYSTEM As you know from newsletter 12, we have been testing an electrical system that does not need the engine's alternator. We are doing this to alleviate the tail heavy condition caused by use of the heavier engines: 0-200 and Lycoming 0-235. N4EZ has been flying since January without the alternator and with a trickle charger for overnight charging. We added a backup battery and a solar cell panel in April. Since the solar panel has been added we have not used the trickle charger. We have powered the electrical system only with the sun. The electrical system has one NAV COM, engine instruments, gear warning horn, and one turn-and-bank gyro. The diagram below shows the electrical system now installed in N4EZ. The main advantage is that it keeps all the weight forward, a necessary requirement for the heavy engines. The solar panel is more reliable than an alternator/regulator system. For normal use (see newsletter 12, page 3) the panel supplies more than enough power even if the airplane is hangared. If extended flying is done under cloud cover or if radio or gyro use is higher than normal, the airplane can be plugged into any 110V AC outlet overnight to top off the batteries.

We are using an off-the-shelf solar cell panel as shown, purchased from Edmond Scientific Corp. This panel is made to be bolted on a roof and take all wind loads and is thus too thick and heavy (0.3" and 2 lb) for our application where the panel is bonded to the skin over the instruments (see photo). We have written to three solar cell manufacturers, asking them to build a panel on a thinner back plate for this application. We have not yet received an acceptable offer. In addition to the diode supplied with the panel we added one in series to

cut the battery drain in darkness to less than one micro amp. Thus, a switch is not necessary to turn on only when in daylight, the panel is on all the time and charges whenever daylight is available. Unfortunately we do not know the designation of the diode we installed. We tried several from a miscellaneous box sold by Radio Shack and selected one (unmarked) that provided less than 1 micro amp dark drain, while allowing full charge in sunlight. Hopefully one of you reading this can determine an available diode spec and let us know how to call it out. Send the diode so we can check it out.**SKETCHES OMITTED**

Stan Sigle sent in an improved wiring diagram for the warning system in section III. This system uses the same switches, just rewired. This prevents the gear horn from honking during nose down parking with the master on. It also warns you to not prop the engine if the throttle is open. Normal function of canopy-open warning and gear-up warning is not changed. Thanks, Stan. **SKETCH OMITTED**

VARIEZE EXHAUST SYSTEM As we told you in a previous newsletter, we have been experiencing failures with the exhaust system in the VariEze. These failures show up as cracks in the tubes, generally at the first bend or flange. Since we were using only mild steel automotive exhaust pipe we thought that going to a stainless system would solve the problem. We tested an identical system fabricated with excellent workmanship from type 321 MILT 6737 stainless. This system had failures in two of the tubes within only 12 hours flying! A materials problem is thus ruled out. We have found that the problem is that of resonance - the pipes are of such a length that they vibrate in harmony with the engine and result in fatigue. This is quite common with new systems. We are taking two approaches to solve this problem. The first has been on N4EZ for the last two months, the second is being fabricated and will be tested when available.

1. Shorten the tubes to raise the natural frequency to eliminate the vibration. The left-front tube has been modified as shown. Its 6.5 inch length has been completely wrapped with a spiral of overstretched screen door spring. A simple carb heat muff is made from scrap from your firewall stainless material. This muff is a cylindrical flange for the carb heat hose and a sheet that wraps around the spring-wound tube. The muff is held on with two springs which snugly hold it on to avoid vibration. Carb heat air is drawn in from each end, over the spring coil and into the flange/hose. The other three exhaust tubes are 7-inch straight stacks, exhausting straight down out of the cowl. The advantage of this system is that it's light, cheap and should solve the vibration failure problem. Its disadvantages are that its loud, and cooling air is lost around the clearance holes for all four tubes. Also, it is possible that these stacks are short enough to cause a valve cooling problem, although we have seen no indications of this yet. **SKETCHES OMITTED**

2. Develop a quiet muffler system. The vendor that fabricates the system for the Cessna 152 has designed and is now fabricating a compact stainless dual muffler system. It will be quiet and will exhaust aft, such that it will not result in loss of high pressure cooling air. It will require a minor cowling modification involving adding two blisters to the existing cowl. Yet to be determined is, of course, if it will have adequate life in service. We will be doing considerable flying once it's installed to answer the question as soon as possible.

Now, for the big question--what should you do with your exhaust system if you have fabricated it to the dimensions of section IIA? We recommend that you immediately modify it, cut it down as described in 1 above, or at least shorten the horizontal members to 6" or less. This requires four new holes in the lower cowl and patching (4 plies BID) the existing holes. If you are flying the long tubes, carefully inspect them for cracks every five hours until you make the modification. If a tube completely fails and falls off in the cowl, the possibility of engine failure or fire may exist. Do modify your tubes. One EZ owner had cracks in only 25 hr flying.

COMPOSITE STRUCTURE We have received a couple reports from builders who conducted static tests without knowing the correct method. One builder set his canard tips on two chairs and jumped up and down in the center. He assumed that this could not overstress the canard since the load data indicated it could take four people on each side. He assumed wrong. The bending moment curve in newsletter 10 was greatly exceeded at b.l. 50 where he showed an indication of failure. If you are going to do a static load test assume nothing. Check carefully the loaded bending and shear data. Never apply loads dynamically unless you have means to measure the dynamic load component. Never apply more than 20 pounds per square inch load on any surface with less than four plys skin thickness.

We recently conducted a series of tests to compare shear strength and peel strength of laminates with a variety of glass surface preparations: wet layup, dacron peel ply, dull sand, half dull sand, and no preparation. Test results support our recommendation to use peel ply wherever a glass layup will be done over a cured glass surface. The additional strength obtained by sanding a surface completely dull does not justify strength loss from removing the top ply to do so. A peel-plied surface or a sanded peel-plied surface is best. Full strength of the original surface is maintained and the itch and work of sanding is avoided.

A recent article stating that one drop of fiberglass resin catalyst in the eye will destroy the eye tissue and result in permanent blindness. The material they were discussing is MEKP, which is a catalyst used in polyester resins, none of which are used on the VariEze. The hardener used in our epoxy resins should be used with appropriate precautions, but does not have the tissue destroying characteristics of the highly toxic MEKP.

From the information we have been receiving about 70 to 80% of you builders have no reaction to working with the epoxy. About 15 to 20% have a mild reaction such as mild skin rash if skin is not protected or shop not well ventilated. About 5 to 10% have more severe epoxy sensitization, some cases very severe. Those with severe sensitization should not be working with epoxy. The important thing to remember is that the effects are accumulative. If you have no reaction you should still use ply 9 or gloves and good ventilation, since your system will build up to the point where you eventually will become sensitized. Do not be over confident and work with bare hands.

Owens Corning has published some test results of E & S type fiberglass applications for Boeing helicopter rotors. "Our tests show that the loads on a metal blade can cause a barely detectable crack to propagate to catastrophic failures in a few minutes--but because of the materials elasticity and its ability to provide alternate paths of stress, crack formation and propagation are virtually nil with glass composites"---we shot both a metal blade and a glass blade with 23mm shells. After 60 hours the level flight plus maneuver tests the glass blade showed no signs of damage propagation but the metal blade fell apart in three minutes"---"other reinforced composites have not proven as failsafe as glass. For example a bullet hole causing a 5% loss in area will cause a 5% loss of strength in a glass blade, but will cause a 32% loss in a graphite blade and a 43% loss in a boron blade." In 1976, 24 million pounds of glass composites were used in aviation--not including 150,000 pounds for VariEzes!

PROPELLOR EFFICIENCY/VARIEZE PERFORMANCE Propellor efficiency is a concept that confuses the average pilot. This confusion is evident in a lot of the questions people ask us. Molt Taylor's propeller article in the May 77 Sport Aviation magazine contained some misleading and incorrect information that has added to the confusion. While it is true that it is impossible to fly faster than the theoretical helix formed by a propeller, you cannot calculate an airplane's maximum theoretical speed from rpm and the pitch value stamped on your prop. The reason is that most prop manufacturers use the flat bottom of the blade as the pitch reference rather than the zero lift line. On a typical high speed prop of say, 70-inch pitch, the actual theoretical pitch measured at zero lift of the blade section may be as high as 79 inches, and will vary along the blade according to the prop designer's method of twist distribution to load the blade the way he wants. Propeller efficiency is, by definition, thrust horsepower obtained, divided by brake horsepower input, and has no direct relationship to helix slip, as inferred in Molt's article. It is common to obtain values of negative slip as high as eight to nine percent at high speed with any low drag airplane, using propeller manufacturer's pitch values, for example: using a 67-inch pitch Cassidy prop on a VariEze at 9000 ft at 65% power and 2650 rpm, the calculated prop helix speed is 168 mph, but the airplanes true speed is 180 mph. At this flight condition, the prop efficiency is not 107% as inferred by Molt, but the technically correct value of 84%. If the airplane's drag were doubled, the "slip" would go from 107% (180 mph) to about 83% (140 mph) and the prop efficiency would drop from 84% to about 73%.

Since we had printed the rpm vs. airspeed data in newsletter 12 we have found that the tach in N4EZ is not producing accurate readings. We recently tested a new propeller and before making conclusions on it we retested two of the previous props. The data did not agree with previous data. We do not know when the error occurred so we must suspect that the newsletter #12 rpm data may be wrong. We will update it when we get our tach calibrated.

We have recently done performance tests with the Jiran wheel pants installed. We have had some difficulty defining the exact performance gained due to some conflicting results in the corrected data. Averaging these it looks like the wheel pant increment at 75% power (full throttle at 8000 feet altitude) is approximately 5 kt (6 mph).

This is less than our earlier estimate of 7 kt (8 mph). We have noted what appears to be a 3 mph decrease due to removal of the spinner.

With pants, N4EZ will indicate 150 kt (173 mph) with full throttle at 8000 ft (75% pwr, approx. 2830 rpm). This is a true airspeed of 169 kt (195 mph). At 3000 ft, full throttle true speed is 173 kt (199 mph). These speeds are about 5 kt slower than the data in the Owners Manual, due to a number of items; protruding solar panel, left trimmed rudder, canopy airleaks and exhaust system. The speeds are lower than we expected, but it is still possible for an optimum VariEze to get 200 mph at 75%--Anyone want to race?

Recently checking some more of the Owners Manual data we have found N4EZ capable of exceeding the rate of climb data at high altitudes and somewhat less rate of climb than the book at low altitudes. Takeoff distance data at high density altitudes (7000 ft) is identical to the Owners Manual.

Other performance data for the low horsepower engines obtained by calculating the static rpm for a 65 hp engine then setting a throttle position to obtain that rpm. Then flight tests were performed at that throttle setting to estimate 65 BHP performance. In general, the Owners Manual data for 65 BHP was confirmed. We had a race with Fred Woodbridge's Xenoah - powered BD5 and found that we had less takeoff distance, better rate of climb and faster top speed than him, while using only 65 BHP!

VARIEZE WEIGHTS One of the biggest disappointments of the VariEze development has been the continual weight growth. The original prototype N7EZ, which used a 140 lb engine had an estimated empty weight of 385 lb. When N7EZ made its first flight its empty weight was 399 lb. Now, after some modifications, addition of electrical system (radio, gyros, etc) its empty weight is 460 lb. When we originally designed N4EZ for a 173 lb Continental A-75 engine, its estimated empty weight was 480 lb. After incorporating a lot of items demanded by the average homebuilder, adding weight to ease construction in several areas and adapting the 205 lb 0-200 with alternator and complete electrical system, N4EZ made its first flight with an empty weight of 570 lb, including an extra heavy paint job. At that time we anticipated that a prudent homebuilder without electrical system could build it as light as 535 lb. N4EZ now weighs about 585 after all its developmental modifications and after removal of alternator.

Our current disappointment is finding that too many builders are loading their airplanes down with extra equipment and heavy finish jobs. They are going to miss the real thrill of flying their EZ at a light weight, and they will find their useful load disappearing. Here is the trap--if you address each item as "Oh, that's only one/half pound, it's a small percent of the empty weight," you will find that the sum of all the extras will add up, and when you weigh your ready-to-fly airplane you will be scratching your head and saying, "where is it all?" Believe me, it happens every time.

We have a strong recommendation for all of you, and that is to delay installation of any equipment not absolutely required for flight, until after you have flown your airplane a few hours. Then, you will have a much better chance of a successful flight test program--the airplane is easier to fly light and uses less runway. Also, if you make a real bad landing during your transition it will put a lot less stress on your landing gear. Then, if you must, load on the equipment, at least you will get to see first-hand the effect it has on performance and runway requirements.

This philosophy also goes for modifications, too. Don't try something new on your unflown new airplane. Build to the plans first, where you know from our experience that it will work. Fly it that way, then try your modification.

VARIEZE FUEL SYSTEM We continue to be pleased with the three-tank fuel systems operation. Its configuration allows you to use all the wing fuel in level flight and all the fuselage fuel in any normal altitude, as well as give you an extremely accurate indication of the last few gallons. This really takes the apprehension out of a situation where you are stretching the range with low fuel. Be sure you are installing the system as shown in newsletter 11, not the original from section IIA. Also, note the operational comments in newsletter 12, page 5.

As you know, the wing tanks must be vented together to keep even fuel levels. Last month I fueled N4EZ then took off after installing only one fuel cap--I forgot to put one on. In flight, the pressure over the cap hole is very low--this caused all the wing fuel to be drawn into the tank without the cap. After about one hour airborne, all the fuel had been sucked out of the other tank (and the line) and the engine quit. I selected the fuselage tank, got an immediate restart and flew home. With the old system (no fuselage tank) I would have had a forced landing. We have added a visual check of the caps to the takeoff checklist. They are easily seen from the cockpit.

We recently learned that the black polyethylene fittings used in the fuel system are not recommended for use with fuel. The manufacturer recommends PVC or white nylon. The same fittings are available in nylon, so we replaced the ones in N4EZ with nylon. The black polyethylene ones have been in fuel in N4EZ for almost a year with no apparent degradation, so it doesn't look like an immediate problem, but you should replace yours with white nylon next time it's convenient to do so. Aircraft Spruce, Brock, and Wicks now carry white nylon. The affected parts are 0715-020 tee, 0710-162 elbow and 0700-162 adapter.

VARIEZE PLACARDS We have noted that several of the VariEzes we have seen are not adequately placarded. All cockpit controls and switches must be labeled. In addition, we recommend the following information. A convenient placard can be made using small rubon letters (stationary store) on white card-stock, protected with a coat of clear epoxy.

Radio call NXXXX
Maneuver speed 120 kt (140 mph)
Gear actuation speed 85 kt (100 mph)
Max landing brake speed 90 kt (105 mph)
Max front seat pilot weight XXX lb
Min front seat pilot weight XXX lb

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No aerobatics    No spins
          Takeoff
Pilot position      Mags
Controls            Carb heat
Trims               Mixture
Instruments         Canopy
Harness             Lift off 60 kt (70 mph)
Fuel - wings        Climb 90 kt (105 mph)
Caps - secure
          Landing
Mixture             Brake Dn
Gear Dn             Approach 75 kt (85 mph)
Carb heat           Touchdown 60 kt (70 mph)
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VARIEZE ENGINES N4EZ, except for the exhaust system, continues to be free of any non-routine engine maintenance. The latest AD on all 0-200's (timing change) was complied with. The only input on engines from homebuilders has been two instances of higher-than-normal cylinder head temperatures (over 400 degrees F). If yours is running over 400 degrees, check for baffle leaks. One builder reported temperatures reduced after 10-hours flying. This is common for newly overhauled engines.

By the time you read this, one or two Lycoming 0-235 EZs may be flying. If they prove successful, RAF will market installation drawings for this engine ("Section IIC") possibly as early as October.

VARIEZE BUILDING HINTS We continue to be asked questions about construction methods that have previously been outlined in newsletters. It is suggested that you note the building hints from all newsletters into the green section of your plans in the appropriate area. Thus, all of this educational material will be in one place for you to review occasionally. It is a good idea to reread the green section every month or so during your construction project to assure you don't forget an important method or hint.

Again, thanks for the hints turned in by you builders--be sure to send a self-addressed stamped envelope along with your suggestions so we can comment on your ideas.

Probably the most troublesome step in the EZ construction has been wings, step 4, page 6-5. There have been a few problems in several areas: 1) it's a long tiring job, ending in an important alignment of several pieces, 2) it covers some glasswork immediately, making it impossible for FAA inspection of vertical shear webs, 3) some builders have not been successful in making a uniform correct thickness layup on the pads in the wing fitting area and have found that they later did not have enough room for the spar cap and skin under the top plate. We are now recommending two improvements that should make this step VariEze. First, layup the 12 and 15-ply BID pads separately. Do this as follows: lay Saran Wrap on a flat surface, layup (RAES) 1 ply Dacron peel ply, the 12 or 15 plies BID and another ply Dacron peel ply. Cover with Saran Wrap, place a flat block of wood or aluminum and load or clamp with about 50 pound force. Let cure. Trim the cured pads to fit the wing fitting, rounding the edges to allow a smooth shear web layup. Peel the Dacron and bond the pads in place. Be sure they fit flush to the adjacent foam surface. This will assure a straight spar

and a pad that is not too thick. The second method change we are recommending is to split step 4 into two separate cures. Stop at the bottom of page 6-5. Peel ply all sides of the box spar. Lay Saran Wrap on a flat surface and set the box on it being sure it is straight while it cures. After cure, peel the Dacron, drill holes for the dowel jigs (see newsletter 12, page 8) and continue with the jigging operation on page 6-6. At this point the aileron cores have been removed from the inboard trailing edge core. Place them back in and hold in position with nails so you will have the straight trailing edge to align the cores in the jig. In summary, an important step has been changed from a long difficult one to three relatively easy ones. Do use the separate-weighted cure method on the four thick pads in the center section spar also--this will avoid a high buildup there.

The lower bolt that holds NG15 to the fiberglass strut must be positioned as shown on page A7. If it is placed in the center of the strut the strut can be split under load. Be sure to use the BID plies here (CP #11, page 4).

Some have complained about having to remove the canard to service the battery--you're right. I'd suggest moving the canard cover joint aft as shown and add an access panel. The hole should be done similar to the hole in the rear seat bulkhead. The door can be a piece of .025 2024 T-3 aluminum using six #10-32 screws or four camlocks. You might even want to reverse the canard lift tab bolts so they can be reached through the new hole--it takes a long arm to reach them through the cockpit. **SKETCH OMITTED**

Several builders have asked how to repair a poor trailing edge overlap in the canard, wing, or winglet. The method shown below works quite well. The surface is prepared for bond, the dry BID cloth at 45 degrees is taped to one side, wrapped to the other side and taped snugly to pull out wrinkles. Once it is taped down well the BID is wet out with a brush (RAEF) and allowed to cure. Remove the tape (gray duct tape works well) and fair in the edges with 36 grit sandpaper. This method can be used full span on the wing for a super strong trailing edge joint, with a small weight penalty. It is not considered mandatory, though. **SKETCH OMITTED**

CP13, Page 5

It is possible to install the Cleveland brake torque plate assembly incorrectly on the outside of the axle. This will bind the brake. Install it the correct way as shown below. **SKETCH OMITTED**

One builder has suggested using carbon paper to trace a reverse pattern of the templates for the opposite side patterns needed. If you use a copy machine to do this, check for paper shrinkage.

The fittings from Brock have a slightly scored finish on the edges due to the punch operation. Use some 100 grit emery paper to polish these scratches out before installation.

A close study of the cross-section drawings in section V will answer a lot of your questions on finishing.

A Sears #93987 Angle Finder is handy for rigging control surface travel and many other jigging operations.

Another material that works well for hot wire templates is Masonite. Sand the edges smooth and lubricate with pencil lead. The hot wire will slip over the graphite with ease.

Do not use paint removers on an epoxy surface.

Layup time can be excessive if epoxy is only 5-10 degrees cool. Keep epoxy at least 75 degrees for best results--one builder stores resin in a cabinet with a light bulb on.

The nose bumper can work loose due to flexing of the nose gear strut. We have it mounted to the fuselage skin with extra BID plies, immediately forward of the gear, directly under the NG31 bulkhead.

Some builders report that a hot-glue gun is handier than the Bondo in many jigging operations. Also, a pair of electric scissors works well in cutting dry glass cloth.

The Westach RPM gauge wiring works as follows: black to ground, green to magneto and red is unused.

Check the length of the AN509-428-16 screws before countersinking the wing fittings. You should leave the heads a little high, not flush. Better yet, use the AN525's and do not countersink.

You may have trouble with the foam tabs on the main gear bending when you install the glass and clamp. You can substitute 1/4 inch plywood for the foam to prevent this. Do not be concerned about shaving some material from the leading or trailing edge of the gear strut to install the 25-ply outside pad. This will not weaken the gear. It's more important that the pads be laid up straight and not made undersized.

Many builders who previously were taking several times the man-hour estimates, now report they can beat the times, when using all the hints in the last several newsletters.

Truss connector plates--gang-nail devises that secure boards of wood house trusses, make perfect securing devices for foam blocks. Use them to bridge two blocks of foam or shove them into a single block and tie string to it to pull it up to another. Thanks, John Carroll.

Canopy locks must be installed in the correct alignment and engage fully in the positions shown on page 22-10. Adjust so the handle must be forced hard forward to engage the lock while firmly squeezing the rubber canopy seal. This prevents the locks from wearing due to rattling and prevents the canopy from locking when it is closed from the outside. I installed a "drawer lock" ($1.69 at any hardware store) in the fuselage side so I can close the canopy and lock it from the outside with a key. The drawer-engage tab is replaced with a longer aluminum arm shaped to engage the center canopy lock bolt in the closed position. We are using the low density foam rubber weather stripping for a canopy seal. This is the real light material that is about 1/4 inch thick but easily squeezes flat.

If you insist on a capability to open the latched canopy from the outside, install a door on the fuselage side aft of the canopy latch. Wicks did this, and included a key lock in the door.

We have received several comments that the return spring at the rudder is too strong. It is possible that if the hooks are installed short this spring will be far too tight. The only requirement for this spring is to return the rudder to neutral on the ground. Inflight airloads firmly return the rudder. The spring can be lengthened or a lower-rate one substituted. It only needs to be firm enough to overcome friction of the system and the rudder pedal spring. We have selected three different screen door springs available at our local hardware store. The dimensions and spring rates are shown below.

	Outside dia.	Wire dia.	Lb/in for 1" length	Max. force
#1	0.30	0.045	31	20
#2	0.35	0.05	38	30
#3	0.39	0.62	50	35

For the rudder return spring you can use either a 4-1/2 inch length of #1 or a 5-1/2 inch length of #2. Both of these have a spring rate of 6.9 lb/inch.

For the elevator trim the upper spring is a 9 inch length of #2, spring rate = 4.2 lb/in. The lower spring is a 13 inch length of #2; spring rate is 3.0 lb/in. If you substitute another spring, be sure to match the approximate spring rate. All lengths mentioned are unstretched length.

R. Godle has turned us on to an epoxy layup roller that works much better than the one suggested earlier. This one has no tendency to lift the cloth and has an excellent stippling action for working out air--we use it on any major layup now. It is called a "3 inch adhesive cover" available at Standard Brands paint stores--stock number 430051, manufacturing number SC251/3V95.

Clarification--the canopy cross brace goes under, not thru, the plexiglass. The plexiglass has no holes on a VariEze installation.

A plywood or metal block bonded to the bottom fuselage skin where the speed brake push rod strikes the skin, will prevent deterioration of the skin edge.

A plywood square mask as shown in the sketch slipped over each end of the centersection spar (step 2, page 8-2), will hold it perfectly square during cure. **SKETCH OMITTED**

In areas where the thickness of glass buildup is important - shear webs, spar caps, pads, etc. - always calculate the thickness (0.13" per ply for BID, 0.009" per ply for UND) and measure the foam core to be sure the foam is the correct size before glassing. The spar cap and skins must make a smooth, straight transition onto the outboard cores (wing and canard). Be sure you fully understand the quality control criteria in "Section I," "Section V," and newsletter 10.

VARIEZE PLAN'S CHANGES We still receive questions regarding changes that have been printed in the newsletters. Be sure to write all plan's changes into your plans, otherwise you may forget and skip them later.

Checklist	Add "check fuel caps" under takeoff checklist
Section I, page 6-5	Photo at top is misleading--method is correct but the part is shaped different--it was from N7EZ.
Newsletter 11, page 7	On the second 22-8 change, the AN509's should be AN525's.
Newsletter 12, page 11	After "ailerons as shown" add the word "below."
Section I, page 22-10	The solid line on the lower drawing of C-7 should be dashed.
Aileron Addendum	6061 T-6 can be substituted for the 2024 T-3 on the 3/4 inch tube.
Section IIA	Modify exhaust as shown in this newsletter
Newsletter II page 6	Add "white nylon" after "Ryan Herco 3 places

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The following Owners Manual revisions were included in the Aileron Addendum to update the manual for an aileron-equipped airplane. They are repeated here so those non-builders that have section IV can get it updated.

Owners Manual Changes For Aileron-Equipped VariEze

Page 7 & 8	Strike first three sentences under Control System Add "Pitch is controlled by a full span canard slotted flap providing a large allowable Cg range. Roll is controlled by conventional ailerons on the rear wing.
Page 8	After the fifth sentence of Trim Systems - Add "The roll trim system is optional."
Page 13	Strike the following - "If it's a strong crosswind .....the wings."
Page 14	Under "Climb" - Add "The VariEze's excellent sideslipping characteristics allows the pilot to sideslip left and right for required forward visibility during steep climbs.
Page 16	Add "Sideslips can be done on final to lose excess altitude.

Strike the following - "At pattern speed.....
right at home."

Strike - "Your separate surface.....corrections
and maneuvering." Change "third method" to
"another method".

Page 18 Strike the second paragraph. Add - Ailerons and
rudder are effective at all speeds including
full-aft-stick flight."
Strike the last sentence. Add - "Sideslips can be
done at any speed down to and including full aft
stick speed."

Page 24 Strike - "A pilot who flies only.....gust during
the landing flare.

Add - "The VariEze has entirely conventional
flying qualities. However, its landing speed is 5 to
15 knots faster than most light planes and should
not be considered as a training airplane to develop
basic flight proficiency."

Strike - "Once on the ground."

Strike the last paragraph.

Page 28 Modify the allowable cg diagram as shown. Note
that when the canard is used only for elevator the
allowable forward cg is greater. This supersedes
the change shown in Newsletter No. 12. **SKETCH
OMITTED**

Page 29 Change "and elevon" to "elevator and aileron".

Strike - Elevator Travel Section.

Add - "Elevator travel 22 degrees +-2 trailing edge
down and 20 degrees +-2 trailing edge up."

Add "Ailerons must both fair into wing at
trailing edge when neutral. At full deflection
aileron T.E. must travel 1.9 "+-0.3" at outboard
end (measure relative to wing T.E.)"

Page 30 Change "elevon" to "elevator and aileron" (four
places).

Page 40 Change "elevon" to "elevator".

Change "pushrods" to "pushrod".

Page 43 Add "aileron modification complied with."

Note: The ailerons make no discernible change in performance.

EZ PROJECT FOR SALE We regret to report that EZ builder A.C. Boyles, a professor at Glendale College, suffered a fatal stroke while teaching. A.C. was a capable and well respected EAA designee in the Van Nuys Chapter. A.C. had nearly completed his EZ and his wife, Lucille, now has it up for sale. Price is $12,000.00 including an OSMOH perfectly balanced A-75 engine. The workmanship is superb on this project. Write Lucille Boyles, 15249 Dorian Street, Sylmar, Ca. 91342.

QUESTIONS/ANSWERS

Q: Can you give me the names of those near me building an EZ or VariViggen?
A: No, we do not have the permission of plan's holders to include their name on a public list. Attend your local EAA meeting and ask who is building. A list of EAA Chapters can be obtained from EAA, Box 229, Hales Corners, Wi. 53130.

Q: How many EZ's are under construction?
A: Approximately 1000, worldwide.

Q: What back issues of Canard Pusher do I need if I'm building an airplane?
A: Ten through current for VariEze, one through current for VariViggen.

Q: Now that the canard is used only for pitch can I shorten it or use a plain flap instead of the slotted flap?
A: No, changing canard area would move the allowable cg range. The high lift with the slotted flap is required at forward cg. The canard is your main wing, carrying about 25 lb/square feet at forward cg.

Q: What type of respirator is recommended to filter epoxy fumes and foam dust?
A: According to the Mining Enforcement and Safety Administration of the Department of the Interior you should select an approved chemical cartridge respirator. Manufacturers are MSA, Welsh, Willson, Scott, American Optical Corp., 3M, Binks, or Glendale Optical Co.

Q: Since the basic bill-of-materials, page Z-Z of Section I has undergone several revisions can I get a revised one, including all newsletter and aileron changes.
A: Yes, it's in this newsletter.

Q: Looking at the CP 12 data it looks like the Cassidy prop is 10 mph faster. If this is true, why are you now flying the Ted's prop? A: Many people including you have misinterpreted this data. N4EZ's maximum speed at full throttle is the same with both these props. The Teds merely allows the engine to turn faster. The Cassidy prop has a little better efficiency at top speed, since the same speed is obtained at slightly less BHP. Since the Ted's prop turns more rpm at low speeds it allows more horsepower to be available for takeoff and climb and thus T/O and climb is a little better. The reason I use the Teds is that I rarely cruise at 75% power and don't mind using 2850 rpm to do so. Due to the small diameter prop the tip speed is actually less than with a Cessna at a lower cruise rpm. I generally cruise at 50% power which is a low manifold pressure, but medium rpm, about 2550. The fixed-pitch prop for a fast airplane is a compromise, designed as a

climb prop to give adequate takeoff performance. Remember that to get 75% power (75 BHP on an 0-200) with a climb prop, you must do so at a higher rpm (lower manifold pressure) than you are used to on your slow light planes. Your engine develops 75% power at full throttle at about 8000 ft.

DISTRIBUTOR STATUS - VARIEZE MATERIALS

Aircraft Spruce and Wicks - Essentially all items are currently in stock. Expect backlog on wheels and brakes. Aircraft Spruce can supply a walkin/pickup order with three-days notice.

Jiran - Immediate delivery on COWL; five weeks on wheel pants and fuel tanks; eight weeks on landing gear and mounted canopy. The unmounted canopy frame is no longer available. When requesting Jiran catalog send SASE with three-ounce postage.

Brock - '77 catalog is now out. Landing brake and all aileron prefab parts are now stocked. Brock's backlog is rapidly improving. His backlog was over 10 weeks on some items. It is presently about six weeks. Over 100 nose gear assemblies were shipped the first week in July.

Cowley - Canopies are available on immediate delivery.

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VARIVIGGEN

VARIVIGGEN PILOT CHECKOUTS As we mentioned in CP 12, N27VV was being made available for pilot checkout of those who have a Viggen nearly completed. We have had three builders come by for this purpose. In each case, we asked them to carefully read the information given in the Owners Manual and newsletter, then give us their comments after the checkout with emphasis on any information that should be passed on to other builders. All three practiced flying from the back seat including pitch control during rapid throttle changes to get used to the trim change. They then got in front and conducted runway flying tests outlined in the Owners Manual and then flew pattern flights. Their comments follow:

Mike Melville - "Burt made the first takeoff and one of the lasting impressions was the sight of the shadow following along in the early morning sun.

Burt demonstrated level flight, slow flight, turns, steep turns, and most important, pitch trim changes with abrupt power changes. This is something that has been emphasized over and over and rightly so. It is an unusual condition, but to be perfectly honest, not a difficult thing to get used to. Personally, I had very little problem with it, however I was thoroughly aware of the condition and I am very current in several different aircraft. This is a point that cannot be too strongly emphasized.

Any person thoroughly checked out and confident in say a Cessna 182, a Grumman Tiger and a tail dragger, in my case a homebuilt Nesmith Cougar, will have no problem with the VariViggen.

After a little stick time in the back seat, we traded seats and I spent quite a while just taxiing the airplane all over the place and let me say this, there cannot be a more simple or manageable airplane anywhere. It is so easy to drive around on the ground and it goes right where you point it, marvelous!

Then I did some high speed taxi runs, again, just point it and go, no problem with keeping it on the centerline, it tracks perfectly straight, and the rudder becomes effective very early in the takeoff run.

Next we tried some nose wheel liftoffs. This must be done in accordance with Burt's instructions in the Owners Manual. Get it stabilized at the speed you want, retard the throttle, then rotate. The nose will come up and is very easy to control. I want to emphasize, pitch control is excellent. Before I tried it, I was worried that pitch control may be marginal. However this is not so at all. Pitch control is really great, you can put the nose anywhere you want to and maintain it there.

Then we did a couple of runway flights, liftoffs and flying in ground effect. Again, control is excellent, both pitch and roll, and I felt very happy in it. Full power takeoff was an anticlimax, it was very normal and flew just like any other high performance single engine. Handling qualities in the air are great. It flies perfectly in my opinion, in fact I was very pleasantly surprised. It is all I had ever hoped for and more!

The landing, again was almost anticlimactic, with the correct airspeed and altitude, it will land itself. The only thing to remember when landing is not to try to full stall land it as you would a Cessna. It is much better to fly it on, the gear is very forgiving and takes care of most bumps. Don't try to hold the nose gear off right down to a virtual stop, because it will stay up until the canard quits flying and then will fall through rather abruptly. This is no problem, but I personally think that you get a nicer landing by letting the nose down before the canard quits. Also, this gives you better braking, as all the weight will be on the wheels instead of some of the weight being carried on the wings, which it would at the high angles of attack, possible by holding the nose off.

If you try to stall it on, it is possible to hit the tail skids on the runway, so until you get really familiar with the airplane, listen to Burt and fly it on!

To recap: make sure you read and fully understand the Owners Manual on test flights. Then go out and enjoy your Viggen, it is a super airplane."

Burt's comments: Mike is a very proficient pilot. He handled the airplane in the first few seconds like he had 100 hours in it. I particularly noticed how well he flew the rudders-- must be his Cougar

experience. Mike should feel right at home and confident on his first flight in his Viggen.

Charles Allen - "Would like to offer some candid observations on my first flight in N27VV. They are designed, hopefully, to benefit other builders. Also, I hope, of some use to you.

I waited to write until I'd had a chance to fly the G.A. Trainer again, which I did today, and go through some of the maneuvers and fast power changes we made in the VV. I have also read the Owners Manual and found it excellent and complete. Can't find much to add, but after a vivid first impression of the VV, would like to underline a few things.

The first and most important question in a builders mind is, how is a VV different in flight from a conventional small plane, such as the Grumman American Trainer? There is one big difference, and it is explained well in the Owners Manual under "stall characteristics." But I think this difference is so important that it should be spelled out, and emphasized again and again. The difference is that there is a completely opposite pitch-trim change from that in conventional planes, and it is much more severe. Put simply, there is a definite nose pitch-down when power is added, and a definite nose pitch-up when power is reduced. The severity of these pitch changes is proportional to the speed with which power changes are made. Therefore, smooth and gradual changes in throttle settings are essential, especially at low airspeeds. And especially during early liftoffs and flight testing. The elevators are quite capable of correcting these pitch changes, but the pilot used to conventional aircraft could easily be caught by surprise, and not correct promptly. Again, the potential VV pilot should commit this concept to memory, and be alert and mentally prepared when starting out on those first liftoffs.

Another strong first impression I had from both the back seat and the front seat, was that a "high angle of attack" does not seem very high. Therefore, I had a tendency to get into a nose-high full stall attitude when landing. A flatter angle, quoting Burt, is safer and better to use.

Have a few more random impressions of first VV flight.

It is really a thrill to look down and see, for the first time, that wedge-shaped shadow following along!

It's true, handling and maneuverability are exceptional. It can be turned on a dime. Visibility is outstanding.

Landing gear operation was very smooth. I noticed little difference in trim. The gear feels quite firm and solid on touchdown. And speaking of landing gear, the VV has the greatest ground handling qualities that I can remember, and I date back to WW II. It is a firm, stable, easy to steer, and has perfect visibility. A real fun airplane.

Engine noise seemed less than in conventional planes, tho I am not sure of the facts. The Lyc. 0-320 responded smoothly and reliably to all kinds of power changes during the flights and on the ground.

Burt's seats didn't fit me too well, but I think seating is an individual thing and must be worked out to each builder's satisfaction.

Though the VV and I are hardly acquainted, I think it's love at first flight--and I'm glad I'm building one."

Burt's comments: Charles handled the airplane well and was able to fly it straight and level during rapid power changes after only a few seconds practice. I'm confident he would handle his Viggen on his first flight with or without his experience with N27VV.

Harold Reiss - "Decided not to go to see Jim at Phoenix, but rather to head on home and get some work done on 29 HR. I think I'll try to get it ready to fly in prime paint only by the end of July and maybe you'll have some time to come by Urbana, after Oshkosh, and try it out. If not we'll see who does first flights later on.

Thanks very much for your time and for the use of 27 VV. It was a real eye opener for me, though I don't feel it is quite as difficult to fly as I led myself to believe, just different in pitch due to power changes. I do feel that it is easy enough to counter if you don't get into a difficult situation such as an emergency go-around before you become accustomed to the reverse pitch change. In a case like that each one of use builders had better be on his toes.

The biggest problem I had, in my opinion, was the high angle of attack during landing. I think this was due to two things. One-the forward visibility, with no engine or prop in front of you, is much better than the average light plane can offer and so gives little to use for reference during landing approach. Two-most pilots were not taught to drive an airplane onto the ground, myself included. It's hard to feel that the nose is still high enough due to that forward picture. However, practice in the VariViggen will overcome this difficulty I am sure.

Each builder who plans taxi tests and first flights should, as you said, get good as well as current in several aircraft types. A stick rather than a wheel and conventional gear rather than tri-gear would be best. (I was just barely current in the Arrow and had flown 6 or 7 hours in the last year, besides the trip to Mojave). Ground steering is excellent and low speed during takeoff is about like a 140 Cessna, though a bit easier.

I think your rudder system in 27 VV leaves a little to be desired, as it was very hard to feel the amount of rudder applied I think the plans built will be much better because of the spring loading at the front rather than the rear pedals, and because does not have those centering bars. I used rudder but apparently not enough--it seemed as if the pedal got hard after about 1/2 inch of movement. I guess the Arrow with its auto pilot lets a person get somewhat rusty. I have started to clean up my flying and next time I assure you it will be better."

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"I do feel that I can get along with the Viggen well enough to start learning the airplane. I would advise all builders not to get into the

airplane, with testing in mind, without a thorough checkout from someone who has become accomplished in a VariViggen. I hope you will emphasize this fact in future publications so that we do not have any bad situations in the future."

Burt's comments: Harold's limited flying experience in the last year did show up in that I had the impression that he was not using the rudder pedals and was letting the airplane stray quite a bit before correcting in pitch. It's difficult for me to speculate how well Harold would do on his own first flights. I did help him some on his first couple of landings. I recommended that he get Mike (who lives nearby) or me to help him on his first flights unless he gets proficient in several other airplanes. While he probably would do fine, mixing probable with the other unknowns possible on any airplane's first flight is not recommended particularly considering the years of work and cost involved in a Viggen as pretty as his.

All three pilots flew the airplane with mid reflex, as recommended in newsletter 12.

VARIVIGGEN PLACARDS In addition to labeling all switches and cockpit controls we recommend the following placards for VariViggen. Having an abbreviated checklist on the panel is real handy.

Radio call NXXX
Maneuver speed 108 kt (125 mph)
Gear actuation 75 kt (85 mph) one-g only
Max front seat pilot weight XXX lb
Min front seat pilot weight XXX lb
No aerobatics No spins
Solo Front Seat Only

Takeoff

Controls	Carb heat
Reflex	Mixture
Trim	Gear Handle
Instruments	Canopy
Harness	Liftoff 60 kt (70 mph)
Fuel	Climb 75 kt (85 mph)
Mags	

Landing

Mixture	Reflex
Carb heat	Approach 70 kt (80 mph)
Gear dn	Touchdown 50 kt (60 mph)

CAUTION: Trim changes with power--forward stick is required when power is reduced.

VARIVIGGEN PLANS CHANGES

Owners Manual page 37	Add "never exceed speed (red line) is 175 mph (152 kt) indicated."
SP Plans page 8	Block on inboard of aileron that is 1.3 inches high should be 1.5 inches high.

VARIEZE TECHNOLOGY TO BE APPLIED TO VARIVIGGEN Dave Burdette, who is building a VariViggen nearby, has caught the composite bug and asked us to design a glass and foam canard for his Viggen. So, after taking a

thorough look at the application, we've decided to also incorporate the high lift airfoil used on the EZ and increase the aspect ratio. This requires less area so the canard had to be tapered to fit the existing bulkheads and control system. Keeping the same elevator pivot at W.L. 18.0 resulted in a need for anhedral to keep the pivot geometry correct for the tapered elevator. The result is a wild looking canard, as you can see from the sketch. We expect to pick up a knot or two of speed and have the same low-speed performance. It should reduce the nose wheel lift-off speed at forward cg. Of course we can't sell plans for this until it can be flight tested. When? Well I'm done trying to guess how long it takes people to finish a VariViggen, but we'll keep you posted in the Canard Pusher. **SKETCHES OMITTED**

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Harold Reiss with SP wings.

Harold's jig for SP wing.

Jig used by Dr. Thomas De Palo for welding MG14 gear legs on his Viggen.

Ron Smith's Viggen in the Jig.

Al Lechifflard's Viggen in the Jig.

Wally Warner's Viggen in April. His is now nearly complete.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

The wing layup is VariEze when you have Dr. Wright's crew.

Dr. James Wright & wife doing the wing assembly.

Dr. Wright's wing jig before being flipped over.

Check this uniform for EZ work!!

Bruce & Mary Muirhead stippling fuselage sides. Note EZ's on aprons!

Meriksens wing jig.

Lee Herron's EZ at rollout

Peter Krauss' EZ at the Paris airshow.

Chet Ellington reports he used a wood box instead of a foam block for supporting the spar during wing alignment.

R. Decate's RC model built from info in the EZ info kit.

N4EZ with Jiran wheelpants.

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VARIEZE UPDATED BILL OF MATERIALS The basic "Section I" BOM (page 2-2) has undergone several revisions, the major one due to the aileron and backseat stick addition. The following is the current list:

EPOXY: RAEF fast cure epoxy 6 one-gallon kits
        RAES slow cure epoxy 7 one-gallon kits
        5 minute epoxy 1 two pound kit

FOAM: Rigid PVC
       16 lb/cubic ft., dark red color, 2 pcs. 60cmx56cmx5mm
       16 lb/cubic ft., dark red color, 2 pcs. 60cmx30cmx5mm
       6 lb/cubic ft., light red color, 2 pcs. 90cmx80cmx9mm
       6 lb/cubic ft., light red color, 2 pcs. 90cmx30cmx9mm
       6 lb/cubic ft., light red color, 1 pc. 15cmx27cmx25mm

       Large-cell expanded polystyrene with flame retardant
       2 lb/cubic ft. light blue color, 4 pcs. 9" x 18" x 67"
       2 lb/cubic ft. light blue color, 1 pc. 9" x 18" x 41"

       Rigid polyurethane slab
       2 lb/cubic ft., Green color, 5 pcs. 1" x 24" x 96"
       2 lb/cubic ft., Green color, 2 pcs. 2" x 24" x 96"
       2 lb/cubic ft., Green color, 1 pc. 2" x 24" x 48"

FIBERGLASS: RA5177UND unidirectional weave 70 yds. (38 in)
             RA5277BID bi-directional weave 119 yds. (38 in)

FILLER MATERIAL: Flocked cotton fiber, 1 lb.
                  Microspheres, PF grade inorganic Q-cell,
                  two one-gallon containers.

WOOD: Birch aircraft plywood, 5 ply. 24" x 36" x 1/4"
       Spruce or fir, 2 pcs. 1" x 0.7" (rectangular) 105 in.
       Spruce or fir, 1 pc. 1" x 0.7" (rectangular) 72 in.
       Spruce or fir, 2 pcs. 0.7" x 0.7" (triangular) 105 in.
       Spruce or fir, 1 pc. 0.7" x 0.7" (triangular) 72 in.

Aluminum sheet 2024 T3 Clad
.125 thick, 1 piece 110 sq. in.
.063 thick, 1 piece 54 sq. in.
???? thick, 2 pieces 12 in. X 12 in.
(.040 is acceptable substitute)
.020 thick, 1 piece 72 sq. in.
Aluminum 90 degree angle 2024-T3511
.125 X 1.0 X 1.5, extruded, 2 pieces, 30 in. long
.125 X .875 X .875, "   , 2   "   , 30 "   "
(.125 X 1 X 1 acceptable substitute)
.063 X 2 X 2, formed, 2 pieces, 12 in. long

Aluminum Tubing
1/4" OD X .032 wall   3003-0, 4 ft.
3/8 OD X .035 wall   3003-0, 8 ft.
5/16 OD X .065 wall, 2024-T3, 1.0 inch (one inch)
3/8 OD X .028 wall,   2024-T3 or 6061-T6, 2 inches

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1/2 OD X .035 wall,   2024-T3, 3 pieces, 47 in. long
1/2 OD X .058 wall,   2024-T3 or 6061-T6, 8 inches
5/16 OD X .049 wall,  2024-T3 or 6061-T6, 4 inches
1 1/4 OD X .035 wall, 2024-T3 or 6061-T6, 1 piece 66 in.
                                          1 piece 84 in
3/4 OD X .058 wall,   2024-T3, 2 pieces 47 1/2 in. long
                 OR 6061T6    1 piece 23 in. long

Steel Tubing 4130-N or 1020
3/8 OD X .065 wall,   3.5 inch
5/8 OD X .049 wall,   23 inches
Steel Rod
3/8 OD common steel rod, alloy unimportant, 88 in.
several pieces ok.
Steel Sheet
.016 thick, type 301 or type 302 stainless, 1 piece 24" X 30"
.050 thick, 4130-N or 1020, 1 piece 9" X 2"

     HARDWARE

AIRFRAME BOLTS
     3/16" Bolts
     AN3-4A (3)
     AN3-5A (23)
     AN3-6A (18)
     AN3-7A (20)
     AN3-10A (8)
     AN3-11A (11)
     AN3-12A (3)
     AN3-13A (2)
     AN3-15A (5)
     AN3-16A (3)
     AN3-17A (1)
     AN3-20A (2)
     1/4" Bolts
     AN4-5A (4)
     AN4-6A (8)
     AN4-7A (12)
     AN4-10A (4)
     AN4-11A (2)
     AN4-12A (7)
     AN4-14A (24)
     AN4-15A (1)
     AN4-17A (2)
     AN4-20 (2)
     AN4-40A (2)
     Misc.
     AN5-40A (1)
     AN6-11A (2)

MACHINE SCREWS
     10-32 Screws
     AN525-10R6 (3)
     AN525-10R8 (8)
     AN525-10R10 (9)
     AN509-10R6 (8)
     AN509-10R7 (7)
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     10-32Screws
     AN509-10R8 (2)
     AN509-10R10 (6)
     AN509-10R14 (12)
     AN509-10R20 (8)
     AN509-10R24 (4)
     1/4-28 Screws
     AN525-416R20 (8)
     AN525-416R14 (64)
     or
     AN509-416R16 (64)

          NUTS:
     MS21042-3 (141)
     MS21042-4 (65)
     AN365-524 (1)
     AN315-3 (4)
     AN316-6 (1)
     AN310-4 (2)

       WASHERS:
     AN960-10 (100)
     AN960-416 (100)
     AN960-816 (2)
     AN960-1016 (2)
     AN970-3 (32)
     AN970-4 (12)
     AN970-5 (2)

NUTPLATES:
     MS21071-4 (2) (ESNA LHTA 57M) (Recessed)
     MS21047-3 (10) (ESNA LHTA 51 or KAYNAR K1000-3)
     K1000-4 (6)

RIVETS:  Hard Aluminum Rivets
         AN470AD3-7 (4)
         AN470AD4-6 (30)
         AN470AD4-10 (28)
         AN426AD3-3 (4)
         AN426AD3-5 (4)
         Cherry Rivets MSP-43 (68) (OR AVEX 1601-0910)
         Cherry Rivets MSC-43 (78) (OR AVEX 1604-0412)

CABLE AND CABLE HARDWARE:
     1/16" diameter, 7 x 7 stainless steel control cable, 30 ft.
     3/32" diameter, 7 x 19 galvanized steel control cable, 24 ft.
     AN100-3 thimbles (12)
     AN100-4 thimbles (12)
     18-1-C sleeve (10)
     18-2-G sleeve (12)

MISCELLANEOUS:
     AN210-2A pully (2)
     AN271-BIO Universal (1)
     AN218-4 (Fafnir BC4W10) belcrank bearing (5)
     Fafnir RE4M6 rod end (1)
     Heim HM3 rod end (14)
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AN393-9 clevis pins (4)
AN416-1 safety pins (4)
AN380-2-2 cotter pins (2)
AN380-2-3 cotter pins (4)
AN380-3-4 cotter pins (2)
AN931-8-13 elastic grommets (2)
MS20001P5 hinge (28 inches)
MS20001P6 hinge (30 inches)
MS20257P2 hinge (12 inches)

1/8" dia., 1 inch long steel roll pin (1) NAS-561-P-4-16
3/16" O.D., High pressure .025 Wall Nylaflow tubing (46 ft.)
No. 269-P male elbow for 3/16" OD x 1/8" Nyloseal (4)
No. 20 gauge unshielded airframe electrical wire (40 ft.)
.03 IN. ASBESTOS INSULATING SHEET, 6 SQ. FT.
5/16" O.D. x .028 wall fiberglass Arrow stock, 3 pieces 18"
Kraft KPS-1511 two-wire roll trim servo, no feedback
1/4" Phenolic Sheet, 1 piece, 1 1/2" X 6 1/2"

INSTRUMENTS/INSTRUMENT PLUMBING:
Airspeed (0-220 MPH) --- $ 34.00
Altimeter, Sensitive --- 110.00
Compass, Airpath C-2300-- 24.00
(4 ft.) Tygon tubing 3/8" O.D. x 1/4" I.D.
(1) 0715-153 polyethylene tee (1/8" pipe thd. & barbed hose)
(1) -015 barbed polyethylene tee (barbed hose, all sides)
(2) 0700-153 polyethylene adapter

TOOLS

Ply No. 9 Gel Skin Protector, (1 lb.) jar
OR
Disposable co-polymer examination gloves, box of 100
Epo Cleanse, epoxy hand cleaner, (1 pt.)
6-in. long rubber squeegee, (2 ea.)
8 oz. unwaxed paper epoxy mixing cups, Lily No. 8SN1, (100 ea.)
Epoxy layup rollers, (2 ea.)
Bristle Paint brushes, 1-in. wide (50 ea.) and 2-in. wide (50 ea.)
Wood mixing sticks, (box of 500)
Scissors, 1 pair Wiss model 20W
Wood straight edge 1" x 4" x 72", (1 ea.)
Decimal tape measure, Stanley No. 61-112, (1 ea.)

MANUFACTURED ITEMS

Custom upholstery/suit case set including 2 suit cases front and rear seat cushions, and head rests. Color - Cobalt Blue
Light weight custom adjustable seat belt/shoulder harness set
Cleveland 5-in. wheels and brakes (1 pair)
OR
Rosenhan light weight 5-in. wheels and brakes (1 pair)
Rosenhan reservoir-type brake master cylinder (2)
OR
Gerdes reservoir-type brake master cylinder No. A-049, (2)
** 2.80-2.50-4 4-ply nose gear tire and tube (1 ea.)
3.40-3.00-5 4 ply main gear tires & tubes (2 ea.)
** 4-inch nose wheel with bearings for 3/4" axle (1 ea.) -

** These items are not required if the nose gear assy. is purchased from Ken Brock Manufacturing.

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VARIEZE

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $2600 (less engine) in about 1000 man-hours, or from prefab parts and materials, costing approximately $4000 in about 600 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair. The VariEze uses the small four-cylinder Continental aircraft engines. The 0-235 Lycoming, stripped of starter and alternator, is now being tested and should be available soon. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 20 gallons of fuel. Frontseat passengers up to 6', 7"/250 lbs and backseat passengers up to 6',5"/220 lbs can be accommodated plus a modest amount of baggage in two custom suitcases. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (60 kt/70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance. THE TEST PROGRAM The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on

structural materials/components, manufacturing methods testing, and many others.

THE HOMEBUILDER SUPPORT The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$94.00	$108.00
Section IIA	$19.00	$21.00
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95
Add 6% tax if Calif resident - newsletter is not taxable.		
*US. FUNDS ONLY		
TOTAL		

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

SECTION IIA - Continental A65, A75, C85, C90, 0-200

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS & PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP AT GROSS WEIGHT:

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	560 lb
Gross Weight	1050 lb
Range at Max Cruise	700 mi
Range at Econ Cruise	850 mi
Min Speed (full aft stick)	55 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6 square feet
Canard Span/Area	12.5'/13 square feet

SPECS & PERFORMANCE WITH 75-HP CONTINENTAL:

Take Off	1050 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	530 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGUES AND DESCRIPTION OF ITEMS.

AIRCRAFT SPRUCE & SPECIALTY CO.
201 W. Truslow Ave, Bx 424,
Fullerton, Ca. 92632
(714) 870-7551 All Raw Materials
Catalog costs $2.

OR

WICKS AIRCRAFT SUPPLY
1100 5th St.
Highland, Il. 62249
(618) 654-2191

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680
(714) 898-4366.
Prefabricated components: wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, Bldg 6, Mojave Airport, Mojave, Ca 93501

(805) 824-4558.
Prefabricated components: cowling, fuel tanks, wheel pants, maingear and nosegear struts, strut cover and nosegear box.
Send SASE with 3-oz postage for brochure.

COWLEY ENTERPRISES, Bx 14, Santa Paula, Ca 93060, (805) 525-5829.
Plexiglass canopy.
H.C. COMMUNICATIONS, Bx 2047, Canoga Park, Ca 91306, (213) 882-0422.
Custom COM & NAV VHF antennaes.

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with	Take off	850 ft
150-hp, fixed-	Climb	800 fpm
pitch prop, gross	Cruise	150 mph
weight.	Full Aft stick	49 mph
Standard VariViggen	Landing	500 ft
Performance with 150-hp.	Climb	1000 fpm
Special Performance Wings	Cruise	158 mph
Specifications	Canard Span/Area	8 ft/18.3 square feet
Standard VariViggen	Wing Span/Area	19 ft/119 square feet
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications	Wing Span/Area	23.7 ft/125 square ft
Special Performance Wing	Gross Weight	1700 lb

PROVEN DESIGN Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS:
AIRCRAFT SPRUCE & SPECIALTY CO, 201 W. Truslow, Box 424, Fullerton, Ca. 92632 (714) 870-7551.
VariViggen spruce kit, plywood kit, hardware, aluminum and fiberglass. Catalog cost $2.

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680 (714) 898-4366.
VariViggen prefabricated components: all machined parts. Catalog costs $2.

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave, Dayton, Oh 45424.
VariViggen plexiglass canopy.

MONNETT EXPERIMENTAL AIRCRAFT, INC, 955 Grace St, Elgin, Il 60120 (312) 741-2223.
VariViggen molded fiberglass parts.
GOUGEON BROTHERS, 706 Martin, Bay City, Mi 48706.
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS, 4102 Twining, Riverside, Ca 92509.
VariViggen welded nose and main landing gear, 1-1/4" sq. steel tube.

BILL CAMPBELL (VariViggen builder), Box 253, Phelan, Ca. 92371
VariViggen prefab brackets and fittings.

JESSE WRIGHT (VariViggen builder), 7221 S. Colorado Ct, Littleton, Co 80122.
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material

sources as they become known. Published quarterly. Price: $4.75 per year first class mail, $6.50 air mail overseas. Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing; 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described. Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles. Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price: $4.75 first class mail, $5.50 air mail overseas.

VARIVIGGEN CONSTRUCTION MANUAL Part 1 of a photo-illustrated construction manual, written by Jim Cavis, S/N 31. Includes fuselage, canard, inboard wing, vertical stabs, control system, and landing gear, along with approximately 100 photos. Part 1 also includes helpful sketches on jigs and numerous building tips. The written information is similar to plans chapter 5, except expanded to about 30 pages. Price: $18.50 first class mail, $20.50 airmail overseas.

THE CANARD PUSHER NO. 14 OCT 77

NEWS OF THE VARIVIGGEN (very vig-in) and VARIEZE (very easy)

NEWSLETTER SUBSCRIPTION - $4.75/year
OVERSEAS AIRMAIL - $6.50/year
BACK ISSUES - $1.00 each

If you are building a VariViggen you must have newsletter 1 through 14.
If you are building a VariEze you must have newsletter 10 through 14.

The "CANARD PUSHER" is published quarterly; Jan., Apl., July, and Oct by

RUTAN AIRCRAFT FACTORY
BLDG. 13, MOJAVE AIRPORT
MOJAVE, CA. 93501
(805) 824-2645

SOME VERY SATISFYING events have occurred since the last newsletter. First flights of two VariViggens and about ten VariEzes have occurred during the last three months. The EAA convention at Oshkosh, Wi. had five VariEzes and one VariViggen attend, each being flown in from out-of-state, plus a static display of a nearly completed VariEze. RAF gave about 30 rides to builders during the show. Langhorn Bond, new FAA administrator got a ride in N4EZ and a demo of its stall resistance.

Last December the prototype VariViggen, N27VV, was promised to the EAA museum at Hales Corners, Wi. The day after the Oshkosh convention N27VV was flown to Hales Corners with Ray Hegy in his Chuparosa on our wing. We landed, taxied to the museum and left both airplanes to the care of the very able EAA museum personnel. It's a little heartbreaking to leave a perfectly good airplane in a museum. N27VV has given us some very satisfying flying experiences. She was flown to the annual Oshkosh flyin six years in a row. She took us on many a vacation trip loaded with baggage. She performed low level maneuvering demos at over 25 airshows, and was flown for a feature film, "Death Race 2000." It is quite fitting that N27VV be preserved at this facility in the years to come, as the future will recognize it as a forerunner of some significant developments in general aviation. Some of these developments are currently under construction at RAF and may enter the general aviation market within the next four years.

The events of Oshkosh 77 will not be covered here, since they are aptly described by Jack Cox in the October EAA magazine, "Sport Aviation." Be sure to read that issue; it has the first article to be published by a VariEze homebuilder/flyer.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Jim Cavis in N31VV before accident.

Mike Melvill during first flight.

Wally Warner in N455VV.

Wally's Viggen landing after first flight.

Warren Curd after first flight.

Peter Krauss's EZ: Note exhaust comes out top of cowl to meet the rigid German noise requirements. This is a straight pipe, no muffler, but ground noise is only 64 DB.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

An SP wing - the all-composite (glass & foam) outer panel that has been flown on N27VV for the last 2-1/2 years is now mounted as a picnic table in front of RAF. The sun & blowing sand environment of Mojave is excellent to determine, at an accelerated rate, the effects of ultra-violet radiation exposure on the composite structure. A portion of the wing is painted with Null-V.

Left to right - Johnny Murphy, George Gibbons, Burt, Dale Findley, & Lee Herron.

All eyes were on the flyby pattern as some EZ riders enjoy themselves.

Taxiing in, all speed boards out.

Dr. Lutz, getting his ride in N27VV

Lined up for engine start for a 4-ship formation demo on the "History of Flight" airshow.

N4EZ with load for Oshkosh trip. Crew weight 310 lb. Baggage included 3 suitcases plus misc items stowed in the spar and rear baggage area - 52 lb total.

EZ's at Oshkosh - left to right, C-85-powered N20VE flown from Cape Canaveral, FL by Johnny & son, Steve Murphy; Lyc O-235-powered N655EZ flown from Boston, MA by Ware Fuller & Dale Findley; O-200-powered N4EZ flown from Mojave by Burt & Carolyn Rutan; O-200-powered N101MW flown from St. Louis, MO by George Gibbons; and C-90-powered N1WZ flown from West Orange, NJ by Diane & Lee Herron.

Shot of wing & winglet at 12,500-ft over NM - Most of our Oshkosh trip was flown above 11,000 ft at 50% power about 175 mph true and 37 mpg.

Three EZ's take off to join the flyby pattern.

Discussing the plan for the next flyby.

Come on Lee - Flying an EZ is not that much fun!

Spirit of St. Louis framed by N1WX.

ONE MORE WORKSHOP
We are scheduling one more composite workmanship workshop. It will be an all day construction seminar and will include flight demos - all VariEze and VariViggen builders are welcome - bring your airplane or uncompleted part of your airplane. If you have a part in which you are unsure of its workmanship or acceptability, bring it so we can inspect it or use it as an educational sample for others. This is not a public open house; only builders are invited. It will be held at RAF, near the west end of the flight line at Mojave Airport, Mojave, Ca. (2-hr drive, north of Los Angeles on Highway 14), on Sunday, December 18, 1977.

FEATURE MOVIE TO USE VARIEZES
Ferde Grofe Films, in conjunction with the designers of the special effects and robots in STAR WARS, is planning a new film, CENTURION ONE. This is a Galactic Western where the setting is a hostile planet and instead of a horse the cowboys fly VariEzes. Studio sets will be used for many of the shots where the EZs will appear to hover, but real VariEzes will be used for flying photos. A lot of the flying filming will be done in the California Desert with as many as 10 VariEzes. Two EZs will be needed for some filming in some remote areas, including South America, Alaska, Africa and Southeast Asia.

Anyone interested in flying their own VariEze in this film? Contact Ferde Grofe Films, 18139 West Coastline Drive, Malibu, Ca. 90265

DID YOU KNOW?

That the long-sought Kremmer Prize for manpowered aircraft was recently won by a southern California group using a Canard Pusher-type aircraft.

That the new models of the Lear jet will use Whitcomb winglets.

That USAF will test winglets next year on a KC-135 tanker.

That NASA is considering new research to investigate the improved stall/spin characteristics offered by the loaded canard concept. A study of the Curtiss Ascender XP55, an aircraft plagued by bad stall characteristics, shows that if it had been modified to a loaded, high lift, high aspect-ratio canard configuration, it would have had excellent stall characteristics.

That Bill Lear got a set of VariEze plans about a year ago. That Bill Lear has just announced he plans to produce an all-composite airplane.

That RAF is about out of the first printing of the VariEze "Owners Manual" and it is being completely updated to show all revisions, current performance, fuel system, ailerons and landing brake. It will be available in November - ask for 2nd edition of "Owners Manual."

BUILDERS' CLUBS - Northeast VariEze/VariViggen builders Paul J. Dexter, 133 Hayden St., Orange, Mass. 01364, would like to form a regional association to help each other with building/flying activities.

Lee Herron, Box 357, West Orange, NJ 07052, is an EAA designee and is willing to help others with composite construction. Lee's VariEze appears elsewhere in this newsletter.

The Minnesota VariEze club is still the largest and most active. Contact George Wilson, 2924 108th NW, Coon Rapids, Mn 55433. RAF wants to thank the following members of the MVEC for their help running our booth at Oshkosh this year: Vic Berggren, Chet Ellingson, John Novy, Nat Puffer, Jim Tome, Chuck Weitzel, Ed Wieland, George Wilson, and R. Woodall.

Colorado VariEze squadron is now active. Contact squadron commander Lynn Miller, 7325 Tabor, Arvada, Co 80005. (303) 421-2261

Other clubs now active include Ohio (Bill Pritz, RR2, Belle Center, Oh 43310), southern Calif (Al Coha, 5173 Leo St, San Diego, Ca 92115), central Calif (RAF Squadron I, Ed Hamlin, 8377 Seeno, Roseville, Ca 95678).

If you are interested in forming a builder's club, contact RAF so we can mention it in a future issue of "Canard Pusher."

The following is the first flight report from a VariViggen homebuilder, Mike Melvill. We are of course pleased to find that his performance is exceeding that in the "Owners Manual!" Wally Warner's (Orland Park, Il 60462) VariViggen flew first flight only three days after Mike's. Mike's Viggen has the standard wing shape in glass and foam. Wally's has the SP wings. Both have 180-hp 0-360 Lycomings.

P.O. Box 561
Frankton, In.
46044
9-27-77

Dear Carolyn & Burt,

Well, we finally got there! At 11:30 AM 9-22-77 I took off from the Anderson Municipal Airport, and everything behaved as it should. I stayed up for about 45 minutes, did not retract the gear and made a perfect landing. I can not describe the feeling, it was absolutely fantastic. Thank you so much for a fabulous flying machine! Later the same day I climbed to 5,500 and retracted the gear and checked it out generally. As of today, I have 13.2 hours on it with no problems. At 7,500 in level flight, she trues out at 170 mph. at 2700 rpm. I have a 70x70 "Ted" prop, but for an 0-360 even that is not enough, as it will over rev at low altitude. At 3500 ft she will indicate 165 mph at 2700 rpm, but this is not full throttle. Initial climb solo is 1500 f/min. At 5000' solo she makes a steady 1000 ft/min. All systems operate perfectly, reflex, electric trim, and gear are really first class and I am very satisfied. My radios (TERRA 360 com & 200 NAV) are really outstanding, and the tower at Anderson says I have the best transmission of any radio in the area. I can not say enough about the airplane. She really is a hell of a fine craft. I love it.

empty wt. 1252 lbs

empty cg 132.78
main tank holds 24.7 gals
wings hold 6.5 each - 13 gals total

So far I have flown it at 125"cg, 124, 123, & 122. It handles well in all planes so far. Yesterday I loaded 170 lbs in the passenger seat and could hardly tell any difference. It takes 16 minutes to transfer 13 gals from the wings to the mains. Cyl head temp runs between 375 & 425, oil temp 165 degrees, ground handling is excellent, brakes are very good. Rotation with full throttle occurs with full aft stick at 70 mph indicated. Initial climb at 85 mph indicated for gear retraction, then trimmed down to 120 mph. for good cooling gives 1000 ft/min. R.O.C. Canard stalls at 60 mph indicated (airspeed may not be accurate at slow speed) will climb with canard stalling & unstalling, and is fully controllable. Side slips well.

Actually it flies just about like yours. I must say I really get a heck of a kick out of flying it. I will enclose some pictures. I painted it off-white with dark green trim.

Sally sends her best regards. Thank you again for making it possible.

Sincerely,
Mike N27MS
Ser#115

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VARIEZE CONTINENTAL ENGINE - installation in N4EZ has been flown about 53 hours since CP# 13. The installation continues to be trouble free. During the Oshkosh trip we found that it is rather susceptible to carb ice, similar to a Cessna 150. The carb iced up three times, each time carb heat was adequate to clear the ice. We found it advisable to cruise with heat on when moist air conditions, cruising at 50% power.

If you are losing more than 1/8 qt oil per hour out the breather, install an oil separator as shown below. This can be homemade by welding ends and tubes into a 4-inch length of 2-inch dia aluminum tube. Several commercial separators are also available. **SKETCH OMITTED**

LYCOMING 0-235 FOR VARIEZE
Good news - development of the stripped 0-235 is proceeding well and availability of section IIC is expected in late November. The 0-235 Lyc development is not being conducted at RAF. Air Sport, Inc., Minuteman Field, Boxborough Road, Stow, Mass. 01775, phone (617) 897-6021 is doing all installation development, all flight tests, and will be providing all homebuilder support concerning the Lycoming. RAF will sell the section IIC drawings at $21.50 ($23.50 for Air Mail over seas) starting in late November. Profits from sales of IIC will go to Air Sport. All homebuilders questions concerning IIC information should be directed to Air Sport.

The Air Sport EZ now has nearly 100-hours flying time and is very close to completion of required flight tests. Cooling, induction, controls, fuel system, exhaust, mounting and cowling have been essentially debugged. The Air Sport EZ is flying with a Jiran prototype Lycoming

cowling. The Lyc cowling is to be available from Jiran by late November (same price as Continental cowl).

Section IIC will include installation of all models of the Lycoming 0-235. The following stipulations must be adhered to: Slick mags must be used. Ring gear, alternator, starter and vacuum pump must be removed. The Lyc is mounted closer to the firewall than the Continental, thus, the balance of the airplane is the same as with an 0-200 with alternator.

Performance with the 0-235 is essentially the same as with the 0-200. Rate of climb will increase about 13% and cruise should be four to five mph more.

VW ENGINES FOR VARIEZE

We still do not have any encouragement to report as yet, except that a serious development program is still planned by Revmaster. Results of their tests will be published here when available. Looking at other programs though does not provide encouragement. It seems that reliable engine experience is the exception rather than the rule. Fred Keller again flew a VW-powered aircraft from Alaska to Oshkosh this year, but even after several years of development, the prototype KR2 and Mini Imp were trailered in.

The two Pazmany PL4A's at Oshkosh this year were powered by Continentals, even though the design and prototype were intended for the VW. Two other new VW-powered aircraft were at Oshkosh. One trailered in, another had an engine failure in route. The Sonnerai's appear to be having adequate reliability using VW's up to 1700cc, but above that (for adequate power for a VariEze) even they admit that reliability is in question.

TAKEOFF PERFORMANCE - Some EZ fliers who found takeoff distances were too long have found they could obtain the "Owners Manual" distances after assuring they met the following:

1. Brakes should not drag - align the nose wheel once on the runway before the takeoff roll so you don't have to ride a brake.
2. Tire pressure should be at least 55 psi; use 70 psi on the 4-ply tires.
3. Lift off at 60 kt (69 mph) at 900-lb gross weight and 66 kt (76 mph) at 1050-gross weight. Raise the nose early but only slightly; i.e. don't raise it high until the above speeds.
4. Be sure you are getting the correct static rpm. Minimum is 2200 for the 0-200, 2100 for A75 or C85, and 1900 for the A65.
5. The "Owners Manual" data are for the Ted's prop. While the Cassady prop is more efficient at cruise, it extends takeoff about 20%.

VARIEZE WEIGHT - A lot of the builders are losing sight of the fact that the airplane was designed for the A75 engine which weighs 170 lbs and without additional equipment. It is stretching things to install the 0-200 less electrical system (195-lb engine weight). It is really stretching things, compromising useful load and making the airplane tail heavy if you install the 0-200 with alternator or the stripped Lyc 0-235 (210 to 215-lb engine weight). You will probably be happier with

overall performance and utility of a 75 horsepower, 540-lb empty airplane than with a 100 or 108 horsepower, 650-lb empty airplane.

Some have commented that, "Oh, I only weigh 160 lb," or, "I plan to fly solo all the time, so I don't mind an extra 50-lb empty weight." This is foolish - the VariEze should always be flown as light as possible, not always be flown at gross weight. I put in enough fuel for the mission required. I fill up N4EZ only when I need the range. If you only weigh 160 lb, are flying solo, and have a light airplane, then you can enjoy some real benefits - spectacular climb; lower approach speed; shorter takeoff and landing; easier on structure, landing gear and brakes; easier to ground handle; much more fun to fly, etc.

Do not install any extras until you know what your final weight is going to be and if you can accept it. The cause for many of the overweight planes is excessive fillers, primers, and paint in the finishing process. If you can, weigh your plane before and after finishing, and let us know the data. We know of some finishes as light as 12 lb., others as heavy as 85 lb!

Bud Bryan's 0-200-powered EZ is now 570-lb empty after removal of alternator; his is the lightest 100-hp EZ I know of - a good goal to shoot for. You should consider an empty weight over 620 as totally unacceptable.

We have had several questions (particularly from those who have ruined their useful load with a heavy empty weight) about what happens if you try to fly over gross. This is not something to be taken lightly, since the number "1050-lb" is literally used over 1,000 times in the structural design, performance calculations, structural dynamics, etc. I have operated N4EZ over gross on about 20 flights, including our trip this year to Oshkosh in which we had full fuel on several flights and 52-lb baggage (see photo). This was a useful load of 529-lb and

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Based on our operational data and a re-look at the structural considerations we can approve operation up to 1110 lb, but only under the following limitations:

1. At least 90-hp engine
2. Taxi and takeoff only on smooth, hard surface. Use 65-psi tire pressure on mains; 75 psi if 4-ply tires are used.
3. Maximum weight for landing limited to 1050 lb.
4. Maneuvers limited to normal category +4g, -lg. No intentional abrupt maneuvers.
5. Add 300 feet to gross weight takeoff distance, liftoff at 70 knots (80 mph), climb at 85 knots (98 mph).
6. Pilot proficiency - at least 50 landings in VariEze before attempting overgross operation.
7. High gross weight should not be considered for routine operation, since the chances of surviving an off-airport forced landing diminish rapidly as weight is increased.

The following list is all the instrumentation in N4EZ. This allows me to fly anywhere I want to go, excludes me only from the handful of large airports at the hub of the TCA's and provides adequate references

to penetrate a cloud deck if in an emergency and caught on top. Any equipment in addition to this list should be avoided, as it does not increase the utility at all, since night or IFR is not recommended.

airspeed	EGT
altitude	CHT
rate-of-climb	RPM
compass (wet)	oil p.
electric turn/bank (stand by)	oil t.
Escort 110 nav/com	

FRIGHT TESTING We recently observed someone taking his airplane to red-line speed for the first time at low altitude. Opening any airplanes envelope, be it a homebuilt or the 10,000th Cessna 150, is a risky flight test that should be done carefully. The first time you do stalls or open up the high speed area, do it at high altitude and wearing a parachute.

VARIEZE PITCH SENSITIVITY - I have flown seven VariEzes and thus have been able to compare variances in flying qualities. In general most have been more sensitive or more difficult to fly in pitch than N4EZ. We have investigated why the average EZ does not feel as "solid" in pitch as N4EZ and have identified the following causes- be sure to check all of them on your airplane.

(1) Control system friction - the system must be smooth and friction-free. If yours is binding or rubbing, fix it before you fly.
(2) Elevator dimensions - check these dimensions on your elevator, measured with the bottom of the elevator level. The airplane will be more sensitive if A is too large or if B is too small. **SKETCH OMITTED**
(3) Aftcg - Those with the big engines with alternators, or those with light pilots are finding that their airplanes are tail heavy. A tail heavy airplane needs to be ballasted with nose weight to obtain a proper cg. To avoid adding a lot of dead weight, it is tempting to fly the airplane near the aft cg limit. This is ok once the pilot is proficient but aft cg makes an airplane more sensitive and more difficult to fly. Thus, we recommend that you initially fly at mid to forward cg, i.e. in the forward part of the first flight box.
(4) Trim authority - The airplane is easier to fly when in trim. To be sure you have enough trim for low and high speeds, check the following and adjust trim springs accordingly: With trim set at full aft (cable wound up to the nicopress sleeve) and stick held neutral, the force at the stick grip should be about three to four-lb aft. With trim set at full forward (cable unwound) and stick held neutral, the force at the stick grip should be about one to two-lb forward.

Those of you who do have the heavier engines and alternators are finding that the nose weight needed to get the cg forward is cutting into your useful load, already reduced with the heavy engine. If this were a conventional airplane there wouldn't be much you could do, short of moving the engine or wing. But, since the VariEze has two widely separated, lifting wings, the allowable cg range can be shifted by shortening or lengthening the canard. Thus a "tailheavy" airplane can

be made to fly "nose-heavy" merely by sawing off canard span, making no change to actual cg! This can be done only up to a point, where directional stability is lost as cg is moved aft. We have tested the flying qualities and confirmed that the canard/elevator is free from flutter at two canard spans - 150" as shown in the plans and 142" which is obtained by sawing 4" off each tip. If 4" is sawed off each canard tip (142" span) you can move the allowable cg range aft 1.2 inches. This is equal to adding 15-lb weight in the nose at F.S. 5.

Let's look at a couple of examples to see what this canard trim can do for you. Assume you weigh 170 lb and you are using an 0-200 with alternator and a small battery. When you do your weight and balance you find you will need 30-lb ballast in the nose to get to the nose heavy condition (preferred for low pitch sensitivity) for first flight. Then later you can remove 1/2 the ballast, but will have to carry 15 lb of lead in the nose for the life of the airplane. If you trim the canard you will find that you only need 15-lb ballast to get to the forward cg you need for first flight. Then, when you are comfortable with the stick forces you can remove all ballast and have the best useful load and a mid to aft cg. Thus, trimming the canard has increased your useful load by 15 lb!

As another example, let's assume you have built an EZ with the engine it was designed for, the A75 Continental. When you do your weight and balance you determine the allowable pilot-weight range is 125 lb to 240 lb. You, yourself, only weigh 130 lb. You note then, that you will always be flying a sensitive airplane (near aft cg limit) unless you carry ballast. You also note that you don't have any friends that want to fly your airplane that weigh over 210 lb. Thus, you decide to trim your canard. With the allowable cg range back 1.2 inches you re-calculate your allowable pilot range as 95 lb to 210 lb. Now, you can fly a "mid" cg range without adding ballast, and your 90-lb wife can fly with less ballast.

In summary, the canard trim to 142-inch span lowers the allowable pilot weights about 30 lb. If the airplane were originally designed for the 0-200 with alternator the canard would have been about 142 inch span. Do not trim the canard to less than 142 inches, in hopes of using further aft cg (aft of 102.2) to balance a heavy Lycoming and a light pilot Directional stability may degrade aft of 102.2 and the canard has not been tested for flutter at less span.

The best time to decide if you want to trim

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your canard is when you have done your final weight and balance and have calculated your allowable pilot weight range and compared it to your weight. However, if you know you are going to use an 0-200 or Lycoming 0-235 and your weight is less than 180 lb, go ahead and trim it now, before your paint job. Same goes for even the A75 engine if your weight is less than 150 lb.

The canard can be trimmed easily without much disruption of the paint job. Refer to the sketch. Using a hacksaw or coping saw, saw off 4 inches from the tip of each elevator. Now saw a 4-inch section from

the canard as shown so the tip can be glued back on (wet micro) and no recontouring of the tip will be needed. **SKETCHES OMITTED**

VARIEZE LANDING GEAR - We are asking all of you to make a change to the main gear mounting tabs. This change is not based on any problem with N4EZ nor any drop test result. N4EZ now has about 500 landings, some of them at gross weight and a few of them quite hard. There has been no deterioration of the gear or attachments, so it is a bit confusing to us to learn that 3 or 4 of the homebuilt Ezs now flying have had failures. One was a complete failure of the tab that allowed Cy Mehling's gear to rotate forward, dropping his airplane on its belly while taxiing. Others were discovered before they completely failed. In one case the bolt or spacer had worked in the tab enough to allow the inside and outside pad layups (page 18-2) to move relative to each other, thus partially peeling the tabs from the strut and making the strut loose. Because these failures are apparently not isolated cases but are affecting a large percentage of the builders we recommend that you update your gear to the configuration shown below before you taxi or takeoff.

The modification does two things. First it adds additional material to the tabs and second, it allows the inside and outside pads to bond directly to each other, preventing the relative motion allowed by the previous foam tab. Here's the method for original construction: make the tabs as shown on page 18-1 from 1/4" plywood, not foam. Instead of the two 3/16" spacers, make the spacers in-between the tabs 1/4" thick and the outside spacers 1/8" thick, otherwise follow step 2 exactly. Modify step 3 as follows: make only the inside layup, using 22 plies BID. Clamp lightly (too much pressure will drive out too much resin) and allow to cure. Using the tab as a guide, drill through the inside pad and trim the edges even with the tab. Now completely remove the tab and sand the faces of the inside layup dull. Do not be concerned if you have to remove a little of the gear strut to fair into the trimmed tab. Apply the outside pad layup using 25 plies all around and an additional 8 plies on each side that just lap over the leading and trailing edges. Clamp lightly and cure. Continue, following step 4. This will now result in a solid glass tab in the 5/8" gap between the aluminum extrusions. **SKETCHES OMITTED**

Do not make the layup wider than 2 inches. A wide layup will stiffen the gear locally and can result in the strut peeling away due to bending loads.

If your gear is already mounted, use the following procedure: saw off the bottom cover from the rear seat, back about 12". Remove the gear. Peel off the 15-ply outside layup pad (chisel and hammer.) Completely remove the foam tab. Layup about 6 plus on the face of the inside pad, butting them against the gear leg. Trim the strut as required for a smooth corner without a joggle. Layup the 25 and 8-ply outside layup as shown above.

Be sure to check that you have the correct 0.6-inch edge distance all around the tab. Cy Mehling's tabs were only 0.33" at the point of failure. **SKETCHES OMITTED**

Since I have been alerted to the failures in this area I have been keeping a close look at the tabs on N4EZ. The forward tabs are

difficult to see, so I made a 3-inch diameter hole in the rear seat bulkhead immediately in front of each tab, to allow inspection. I recommend that you make these holes in your airplane. They do not show, since they are covered by the back seat cushion. Use a pin router or hole saw.

CP14, Page 6

While on the subject of gear strength, a reminder is in order to check that the nose gear strut is installed properly. If this is done wrong its strength is as low as 1/10 and will barely support the airplane's weight for taxi! **SKETCHES OMITTED**

Several builders have had various problems with the Rosenhan wheels/brakes. If they are not kept in adjustment they can allow the piston to move too far out and result in O-ring failure. They must be adjusted as follows: turn the adjustment nut until the wheel will not rotate by hand. Back off 1/4 turn only. Check adjustment often. Use only the red MIL H 5606B aircraft fluid. Aircraft Spruce has it by the quart. I have been discussing the homebuilders' experiences with Fred Rosenhan, manufacturer of the wheels. He informs me that he now has a direct-puck actuation brake pad (like Cleveland) in the prototype stage. If it is successful it should increase the effectiveness of braking and eliminate need for adjustment. It is being designed to retrofit on the current Rosenhan wheels. We will keep you posted on the progress of this item.

When you drill the holes to join NG10 and the NG11 block, NG10 must be fully in the lock notch in the instrument panel. If this hole is drilled with NG10 to the left in the slot, the NG11 will not be fully engaged in NG13 with NG10 locked. This can result in NG10 popping out of its lock and the nose gear retracting. This happened 3 times to Dale Findlay on his trip to Oshkosh. Our experience has been that as long as NG11 is snubbed firmly into NG13 on both sides with NG10 in the lock, the nose gear has a very positive down lock. Be sure that the knob has the full one inch of snub (page 17-10) The weakest link in the nose gear is the NG10 pushrod which will buckle between NG11 and NG9 if an overload occurs.

Peter Krauss modified the NG10 lock with a system that is more complex but eliminates the need for NG10 to move sideways and provides a more positive lock. The mod involves making the slot in the instrument panel a straight line. A bracket is added that snaps over NG10 when snubbed down. The pilot must push the bracket out of the way to retract or extend the gear. **SKETCHES OMITTED**

VARIEZE FUEL SYSTEM

It has been determined that, due to a vendor error, some of the fuel cap O-rings in the Brock caps are of the wrong material. They will swell when wet with fuel and make the cap difficult to install. To check yours, soak your cap in fuel. If the O-ring swells enough so it doesn't fit the ring properly, return your O-rings to Brock for replacement.

It is possible to place the main fuel tank drain fittings (CP #10 pg. 6) in the tank such that they do not drain the low point during nose

down parking. This can allow water to remain after draining. Refer to the sketch and build a ledge in front of the fitting (if necessary) such that the drain is at the lowest point. The ledge can be urethane foam with one wet ply of BID. **SKETCHES OMITTED**

The fuel shut-off valve, when received has high friction. This is reduced when wet with fuel. Slosh your valve with fuel before installation to remove any grease and to verify that it does not bind excessively. The torque tube, installed as per newsletter 11 has a gentle curve from front to rear and is supported at the rear stick area. Some builders have found that one of the following methods improved torque tube operation and installation. **SKETCHES OMITTED**

When installing the fuel system be sure all components are placed exactly as shown on the drawings. Be sure the tee sits flat on the floor and the note on the bottom of CP 11, page 6 is followed. Do not vent the fuselage tank to the same vent as the wings. With separate vents you have redundancy in case the fuel vent gets clogged.

CP 13 alluded to the possibility that the Bendix carb will not work (pg 1). Johnny Murphy now reports his problem was a totally blocked vent, and once cleared, the fuel system operation is excellent with the Bendix carb. Johnny discovered the blocked vent only after a forced landing in which he had to glide 10 miles to an airport.

Do not modify the fuel valve's design feature that causes it to interfere with the pilot's wrist when the fuselage tank is selected. Already one VariEze has had a forced landing when the pilot ran the fuselage tank empty during touch and go's. This would not have happened had he done at least one of the following correct things: build the valve handle to plans, read the checklist, select the other tank when engine fails.

Remember, the fuselage tank is only required to extend your range by allowing full use of the two gallons of unusable wing fuel (unusable in extended descents). Unless you are stretching your range over 700 miles you never need to select the fuselage tank. You will find that you rarely use fuselage fuel, but it is extremely useful to be able to completely use all wing fuel when needed due to headwinds or weather. The fuselage tank also provides redundancy. If the cause of an engine failure is unknown, immediately select your other fuel supply.

CP14, Page 7

VARIEZE EXHAUST SYSTEM - As you know from CP 13, the four-post exhaust system had to be shortened to avoid vibration failures. CP 13 instructed you to shorten your system but did not have a drawing showing all details. The drawing below shows what the system looks like after shortening. Note that it must fit rather tight on the intake manifold to allow adequate cowling clearance. If you have an original-length system from mild steel, saw out a portion of the horizontal length and take it to a welder to get it welded - most auto muffler shops can do an adequate weld on mild steel tube.

The quiet muffler system mentioned in CP 13 has been flown on N4EZ. It is very quiet, weighs about 8 lb, but presently robs too much engine

power. The manufacturer is now modifying it to lessen the power loss. Installation of the two-can muffler system requires "bumps" to be added to the lower cowl (see sketch). It is similar to a Cessna 150 in external configuration, but has far superior sound deadening qualities. We hope to have its development completed in time for it to be available when CP 15 is published. **SKETCHES OMITTED**

VARIEZE PLANS CHANGES - Be sure to copy these into plans.

Section I, A3	Add the following dimension to all four landing gear extrusion drawings: **SKETCH OMITTED**
Aileron Addendum Page 5	The ZigZag hotwire template for template Y and B has the ZigZag misplaced too far forward. Move the ABCDEFGHIJK ZigZag lines back 0.2" toward the trailing edge.
Section IIA, pg. 13	Drill a 1/4" hole in the low point of the air inlet hose to drain fuel for a flooded start. (low point with gear retracted).
Section pg. 18-2	Modify main gear tabs as shown in this newsletter.
Owners Manual page 28	Replace cg chart with those on page 6 of this newsletter.
Section I page 24-4	The 0.3" dimension should be 0.75. This results in the lower winglet being canted outward about 30 degrees from vertical to lower dihedral effect and reduce wing rock at low speeds.

NOTE: Stall characteristics have been found to vary from airplane to airplane. Most Ezes and Viggens are not susceptible to departure and can be flown trimmed at full aft stick. Some do exhibit more wing rock than others. Peter Krauss reports that his Eze cannot be flown at full aft stick; that at about 60 mph one wing drops abruptly. This is probably due to incorrect wing twist, as Peter's airplane has required a relatively large trim tab on the wing. Be sure to determine your airplane's stall characteristics at altitude and with a parachute.

VARIEZE BUILDING HINTS - Thanks again to those donating their ideas for this column. Be sure to note the building hints from all letters into your plans so you won't forget them when you reach a particular point during construction. When submitting a building hint please include a self-addressed stamped envelope so you can receive our comments.

Ray Mucha - "When joining canard and wing cores first put the templates together and drill the nail holes all in the same place. Then later when the cores are joined, a wooden Q-tip stick or round toothpick in a few of the nail holes will hold the cores in alignment."

Bill Rice - Low cost syringes in 3cc, 12cc, 35cc, and 60cc used by large-animal vets, can be used and reused to measure resin and hardener. Be sure you check the ratio obtained on your epoxy balance to confirm you are getting an accurate 1-to-5 by weight ratio."

Jim Smith - "Rather than using only the top template to check canard incidence, a double one (as shown) clamps completely over the canard to give a more accurate incidence check that is less affected by local bumps." (See photo.) **PHOTO OMITTED**

Phil Supan - "Use a plastic garbage-can liner to keep epoxy off clothes. Cut three holes, one for your neck and two for arms."

Problem - Dacron peel-ply material wrinkles and is difficult to stipple into place. Solution - use Dacron surface tapes, available in rolls in the correct 2.7-oz weight (Aircraft Spruce catalog pg 99). Apply the tape in individual strips over large areas. You will need about three rolls of 1" tape and 2 rolls of 4" tape.

Dale Findlay - Dale devised a clever way to lock the canopy from the outside by installing a removable link between the canopy handle and the lever for the speed brake. When the speed brake is closed from the outside, the canopy is secured. To open the canopy he pries the speed brake open, which opens the canopy handle! The link is a piece of .063 2024 with two holes about 5.8" apart.

Vic and Mary Sullivan - "Any type cake decorator's cone can be used to apply dry micro. After hot wiring the aileron piece from the wing, nail it back into place so you have the full straight trailing edge available to accurately jig the wing. Remove it before skinning wing."

Dick Cobean - "Updating plans is easy if you Xerox the newsletters then cut and paste the hints and changes into your plans."

Some builders are still having problems drilling and tapping the steel inserts in the canard for the lift tabs. We recommend only the method using the predrilled 1/8" aluminum insert with nutplates installed (see newsletter #10, pg. 3).

Robert Purdy - "When drilling the NG13 holes in NG30 plates, clamp the NG30's together, clamp the NG13 on and use it as a drill guide. (page 17-5)

Cy Mehling - "Failures that occurred with the 5 volt regulator in the roll trim circuit were solved after installing a 10 watt, 50 ohm resistor in the lead to 12 volts." This is the only case I know of here - has anyone else had to replace the regulator?

If you have purchased a Jiran mounted canopy be sure to check its width before mounting the reinforcements and laying up the inside skin. It may have to be bowed inward somewhat to have adequate room for mounting the 3 brackets on the left side.

When the Jiran fuel tanks are trimmed to fit the fuselage side and wing rib they may end up about 0.8" aft on the fuselage as is shown on the plans. This is ok.

If you want to reverse the canard tab bolts to allow forward removal (CP #13, pg 5), install the nutplates on the back of F22 as follows: rivet the nutplates to a 1.5-inch dia. piece of .125-inch thick aluminum. Bond the alum washer to F22 and overlay with one-ply BID to secure it.

Pieces of BID cut at 45 degrees are easily distorted if picked up incorrectly and will not fit the part without a lot of cloth movement in place. To avoid this, roll the piece up while it's still on the flat cutting table, carry it carefully to avoid stretching, then roll it onto the part.

One builder reports his fuel gauge is not readable in other than ideal light. The key to good gauge contrast is to avoid any trace of foam or micro in the gauge area. Lay a strip of gray duct tape or plastic electrical tape in the gauge area before glassing the inside of the fuselage. This saves the work of sanding away all traces of foam. Remove tape before glassing outside. Be sure no micro gets on gauge. Sand both sides smooth and coat with epoxy.

You can generally tell the quality of a man's workmanship just by looking at his shop. Clean up and sweep after every step. Keep your tools organized and clean. Dirt in or under a layup will increase weight and decrease strength. A clean shop will reflect on your airplane, and will make construction more pleasant.

A flour sifter is excellent for getting any lumps out of micro. Keep micro bag closed to avoid moisture.

A key to a good glass layup is preparation. Copy the check list below and post in your shop:

BEFORE ANY GLASS LAYUP

1. Tools cleaned & available
   squeegee cups & sticks
   brush scissors
   roller ply 9 or gloves
2. Workbench clean
3. Glass cut & rolled
4. Surface to be glassed -
   correct shape & smooth contour
   sanded dull
   dust blown or vacuumed off
5. Temperature of room and epoxy 70 to 80 degrees F

VARIEZE ERRORS - HOW TO FIX

Now that the plans are essentially debugged by CP #10 through #13, the most common call or letter we get from builders starts with, "I goofed, how can I fix it?" The following are accepted practice to repair common errors. Of course, it's best to be careful and avoid the error in the first place. Remember, most errors can be avoided by reviewing your newsletters.

ERROR: Depression in skin or spar cap in span wise direction on wing, winglet, or canard.

REPAIR: Sand surface dull. Layup UND plies cut as shown to fill depression, fiber orientation spanwise. Add one ply BID at 45 degrees lapping two inches on each side of depression. This repair is allowable for depressions up to 1/10 inch deep. **SKETCH OMITTED**

ERROR: Bump in skin or spar cap in wing, winglet, or canard. REPAIR: Using a hard block, sand bump level. Determine number of plies in area of bump. Sand completely dull the area around bump to a radius in inches equal to number of plies at bump. Layup the same plies as effected area, being sure to observe fiber orientation. Add one ply BID at 45 degrees as shown. **SKETCHES OMITTED**

ERROR: Inadvertently sanded through plies during finishing process.
REPAIR: Determine number of plies damaged. Repair as shown in "bump" repair above.

ERROR: Due to incomplete wetting of layup I have several pin holes in my wing fuel tank so it will not meet leak check.
REPAIR: Pull a mild vacuum (1500 ft) on the tank. Hold the vacuum for 1/2 hour as you brush, stipple, or rub epoxy over the area with pin holes. Then vent tank to equalize pressure. Paint a coat of epoxy over effected area. Be sure tank is vented during cure.

ERROR: Sparkplugs strike top cowling due to cowl being installed too low.
REPAIR: Cut holes in cowl over sparkplugs and build bumps (CP #8, pg 7).

ERROR: Drilled out threads on one of the wing attach bolts.
REPAIR: Install a nut on the bottom - dig out and replace foam from the root end.

ERROR: Air bubble caused by attempting to glass around corner without radius.
REPAIR: If height of void is less than 1/10 inch, drill two small holes and force epoxy into void. If bubble is large, sand away and follow repair for "bump" above.

ERROR: Foam cores jigged in wrong position so that wing or canard will have joggle when glassed.
REPAIR: Cut core loose and bond (wet micro) in correct position before continuing.

ERROR: Glassed surface feels "tacky" after one day cure - This is generally due to improper measuring or mixing of epoxy (too much hardener).
REPAIR: Raise temperature to 80 to 90 degrees for several days. If still tacky and surface will not make a white mark when scratched with a sharp knife, the layup will have to be stripped (peeled) off and redone. Before continuing, do a test mix in a cup and check its surface for a good white scratch mark after cure. Check resin or hardener for settling (CP #12, pg 4).

ERROR: Due to a poor or heavy layup, elevator or aileron will not balance to specification.
REPAIR: Start over; sloppy workmanship cannot be patched on these parts.

ERROR: After wing was completed I noticed that shear webs were butted on sides, rather than top and bottom.
REPAIR: This is a very extensive repair but does save $ and time over the job of completely replacing wing. Cut skin as shown on wing bottom. Remove foam wedge. Sand entire shear web face dull and glass with 3-ply BID at 45 degrees. Put in new foam wedge with wet micro. Be sure wedge fits well to avoid exotherm. Patch skin as shown in "bump" repair above. **SKETCH OMITTED**

QUESTIONS/ANSWERS - Your questions can be answered directly if you include a self-addressed, stamped envelope.

Q - I know bare foam must be protected from sunlight and the epoxy must have an ultra-violet barrier to protect it from long term exposure, but is it okay to put my unpainted structure outside for a couple of days for rigging?
A - Short exposure is okay, but if it is for more than a few hours it should be covered (paper or cloth is ok).

Q - Is there any way to check the incidence of my winglets after the airplane is built?
A - The method shown below is an easy way to confirm that the left and right winglet incidences are equal. Measure "A" from the winglet leading edge at the wing top skin to a point on the aircraft centerline (prop hub or spinner tip). Measure "B" from centerline to the winglet trailing edge at bottom of rudder (rudder held neutral). Check that "A" minus "B" is the same for left and right winglets.

Q. I have built one wing with 90-deg fiber orientation on the BID rather than the 45-degrees shown on the plans. Is this ok?
A. No! Fiber orientation plays a very important role in the stiffness and strength of a composite structural component. Do not modify orientation, even on a bulkhead.

Q. I have bolted my Cleveland wheels and brakes to my axles but things don't fit right. What now?
A. Check two things - orientation of torque plate (CP 13 pg 6) and spacer rings. Two rings per axle must be used to not only space bearings but to provide dirt seals. Spacer rings are available at Aircraft Spruce and Brock.

Q. My cockpit vent on my Ez does not flow air below 100 mph. Can I fix this?
A. I have noticed this on other EZs I have flown. N4EZ's does flow down to 60 mph. I think the difference is due to a change in slope of the canopy frame. The change was made after N4EZ was built to improve forward visibility. I think your vent will work at lower speeds if you carve a smooth radius on the front and sides and raise the rear lip about 1/4 inch.

SHOPPING
We have found another source for the epoxy layup rollers. They can be mail ordered from IASCO, 5724 W 36th St, Minneapolis, Mn 55417. Ask for 1-1/2 texture roller - 99 cents each.

The diode for the Edmund solar panel (CP 13) can be two 1N4004 silicon rectifiers in parallel. We have not yet been able to get a thin solar panel produced, but we do have someone working on it. Energy Saving Systems, 8800 W Chester Pike, Upper Darby, Pa 19082, has a unit similar to Edmunds. If anyone knows of a source for a panel at a price less than $40 per watt, please let us know.

Jim Cavis reports that he is working on the second part of the Viggen construction manual and that repairs to N31VV are in progress.

WANTED: Completed VariEze, all considered. Barclay, 1109 E Broadway, Glendale, Ca 91205 (213) 241-4835.

FOR SALE: Partially-complete VariEze including C-85 engine. Cecil Muchmore, 7237 Via Amorita, Downey, CA 90241 (213) 927-5802.

FOR SALE: VariViggen project incl 0-320 Lycoming, almost all parts. Bill Lake, 1094 Madrone Way, Livermore, Ca 94550.

VARIEZE BILL OF MATERIALS
Most builders are finding that the kit has ample epoxy, enough glass if you use scraps wisely, but only about 1/2 the required amount of microspheres.

VARIEZE AND VARIVIGGEN RETENTION OF CANOPY
As we have mentioned several times before canopy retention is very important. An inflight canopy opening has resulted in the destruction of Tony Ebel's VariEze and a horrifying pattern flight by Peter Krauss. Peter took off without the canopy locked. It opened wide open at 100 mph during the initial climb. He grabbed it, pulled it closed on his fingers and held it while he returned for a good landing. Tony had a canopy latch that was adjusted so loose that it allowed the canopy to rise and fall noticeably during flight. Tony was flying at 6000-ft altitude and 185 mph true (165 indicated) when the canopy opened. He doesn't remember if he had bumped the latch. When it opened the airplane immediately departed from controlled flight, yawed, pitched down past vertical, did a 1/4 turn spin, then pitched up. Tony grabbed the canopy, it was pulled from his hand and the airplane repeated the above maneuvers. This happened about six times until he finally got the canopy closed with fingers outside (Tony did not have the knob installed on the inside). Once recovered to level flight (only 800-ft altitude) he noticed that his prop was stopped and thus he had to make a forced landing.* Due to a combination of almost passing out and fear of the canopy opening, he did not flare. He shoved the stick forward near impact. His own words follow:
"When the canopy opened, it was as if someone threw a hand grenade.** It really startled me. I knew I was in trouble. The plane shuddered and shook. Then started a left turn. It slowed down very fast.

After the first few wild gyrations, spins to the left, recovering straight down, etc., I got it to stall, nose high, and tried to close the canopy. As it fell, the canopy pulled open. This went on for the 5000 ft I fell. I wish I had tried a steep right side slip, or a full power stall, while trying to close the canopy. I was in (a) tense situation, real busy, jump or close it. I did not register any other event. As soon as the canopy came shut, and I noticed that the engine was dead, I had a thought that the sky was getting overcast. I had trouble thinking, finding a field and getting in position. I put the gear down. Then just as I landed, I thought..why did the sun go down? So I shoved forward on the stick, but the bean field was real dark, I heard the nose wheel breaking. Nothing more till after the wreck. So I was out, before I hit anything. Probably lack of oxygen, as maybe I was not breathing much on the way down.... I knew the fence was just ahead. I had tried a 90 degrees turn at about 70 ft., had to level it just before I landed, got 45 degrees of the turn.

Next day I walked the field. It was smooth and solid. So the gear probably would have stayed on, but I would have hit the fence.

I know now..don't try to knock the gear off by pushing on the stick. If I would have been really alert and not passing out, I could have landed in a circle and gotten away from the fence.

Spread the news that I have a good canard, good canopy frame and a repairable left wing for sale, damaged fin and tip, good fitting." Tony's airplane dug a large hole, cartwheeled once, tore off the right wing and ended up inverted. Tony dug himself out and found that his injuries were minor - cuts and bruises. The airplane was extensively damaged. Since this was the first major overload failure condition on an Eze structure, I was quite interested in inspecting the modes of failure. I flew over the next day and observed the following: wing failure occurred in the spar caps, 3 to 6 inches from the wing fitting - there was no damage in the fittings, winglets failed either in the wing or at the winglet 1/2 span. The joint did not fail. The canard, itself, was not damaged. All seat belt fittings were intact. The canopy plexiglass was broken in front but the canopy frame was not damaged. The forward fuselage back to instrument panel was totally destroyed. The rear seat area, fuel tanks, c/s spar, fuselage tank, etc., were undamaged. The engine, mount, firewall and everything in engine area were intact and not damaged. Nosegear strut and all its fittings were undamaged. The maingear tabs failed. The gear strut failed at 1/2 span.

* While the prop will windmill down to 60 kt, once stopped you must go above 120 kt to restart. Tony's engine failed due to negative "g" at a speed below 60 kt during gyrations.

** At that high speed it is surprising that the canopy was not torn off. The gyrations at that speed (above maneuvering speed) also should have resulted in airframe failure, but none occurred.

I am confident that inadvertent canopy opening cannot occur if the canopy is built and adjusted properly and locked before takeoff. The handle should be rigged so it must be forced hard forward to engage the latch. The latch and handle should be rigged for preload toward each other. Thus it is impossible to open it by bumping the handle. It

should take two hands to open. Be sure the latches engage fully in the positions shown on the plans. Do install the warning horn that sounds if takeoff is attempted without canopy fully locked. Do use your checklist. Do not omit the canopy inside knob.

CP14, Page 11

VARIVIGGEN PLANS CHANGES

Pg 41	Shorten FP3 0.8-inch to move master cylinder closer to pedal, to increase brake effectiveness. Pedal must be vertical or canted aft at the top for best brake effectiveness.
Cowl installation instructions	Baffling must fit tight all around with no large leaks, to prevent overheating.

NOTES FROM THE DISTRIBUTORS
Jesse Wright now has a VariViggen tail rib kit. Contact him for details.

Note the new address and phone number for Cowley, Inc. on the enclosed flyer. All plexiglass work is now done at Mojave. Send SASE for info to them. Remember that if you drive in or fly in to get a canopy it comes in a 96x26x14-inch box, which will not fit in a small sedan.

Jiran - all items except wheel pants will undergo about a 10% price increase, due materials & labor inflation, on 1 Jan 78. Jiran needs input from you to determine volume of Lycoming cowlings. They will be in production soon. Backlog is still about two months for gear; less for other items. Send SASE for current delivery status. Send 35 cents postage for complete brochure.

Brock - current backlog is still six to eight weeks, but panic needs can be filled in less time. Brock's $1 catalog shows photos of all available parts; many parts are available that are shown as homebuilt-only in the plans. See his catalog for complete list. Brock now stocks the pin router mentioned several times in the plans, as well as piloted countersinks.

Aircraft Spruce & Wicks can still supply a complete kit for pickup if given about two days notice.

Aircraft Spruce has recently added a few hard-to-find items not listed in catalog:

1. Instrument quick-handy template for layout of instrument holes - all sizes $6.75
2. 3 in 1 engine gauges - oil temp & pressure + fuel pressure.
   15' capillary for VariViggen $65.
3. Epoxy wood sealer for VariViggen inside sealing $11.75 per qt.

GLASS AND FOAM STANDARD WING FOR VARIVIGGENS

We have worked with several VariViggen builders on an individual basis concerning how to build a standard-shaped (like the metal wing) wing panel out of glass and foam (like the SP plans). Now that a glass and foam standard wing is flying, we are passing the information on to you here. For all details of construction not shown here refer to the SP plans. Also, follow newsletter hints for VariEze concerning glass work.

Use the lofts on page 8 and 9 of the plans for templates at B.L.48., 79.5, and 114. The stub spar is 31.5" long and is shaped to fit the cores less the thickness required for glass spar caps (.012 per ply for 5277; .009 for 5177).

Follow SP plans for spar cap dimensions and all fittings. Follow the sketch below for aileron size and skin glass configuration. The best epoxy is RAES (1 gal required) for foam bonding and heavy caps and RAEF (3 gal required) for skinning. Refer to your buddy's set of VariEze plans for additional hints on the glass work. 5277 is called BID; 5177 is called UND. **SKETCH OMITTED**

VARIEZE

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $2600 (less engine) in about 1000 man-hours, or from prefab parts and materials, costing approximately $4000 in about 600 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair. The VariEze uses the small four-cylinder Continental aircraft engines. The 0-235 Lycoming, stripped of starter and alternator, is now being tested and should be available soon. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 20 gallons of fuel. Frontseat passengers up to 6', 7"/250 lbs and backseat passengers up to 6',5"/220 lbs can be accommodated plus a modest amount of baggage in two custom suitcases. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (60 kt/70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its

stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance. THE TEST PROGRAM The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE HOMEBUILDER SUPPORT The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$94.00	$108.00
Section IIA	$19.00	$21.00
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95
Add 6% tax if Calif resident - newsletter is not taxable.		
*US. FUNDS ONLY		
TOTAL		

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full size drawings. It includes 168 photos, over 800

drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

SECTION IIA - Continental A65, A75, C85, C90, 0-200

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS & PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP AT GROSS WEIGHT:

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	560 lb
Gross Weight	1050 lb
Range at Max Cruise	700 mi
Range at Econ Cruise	850 mi
Min Speed (full aft stick)	55 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6 square feet
Canard Span/Area	12.5'/13 square feet

SPECS & PERFORMANCE WITH 75-HP CONTINENTAL:

Take Off	1050 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	530 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGUES AND DESCRIPTION OF ITEMS.

AIRCRAFT SPRUCE & SPECIALTY CO.
201 W. Truslow Ave, Bx 424,
Fullerton, Ca. 92632
(714) 870-7551 All Raw Materials
Catalog costs $2.

OR

WICKS AIRCRAFT SUPPLY
1100 5th St.
Highland, Il. 62249
(618) 654-2191

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680 (714) 898-4366.
Prefabricated components: wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, Bldg 6, Mojave Airport, Mojave, Ca 93501 (805) 824-4558.
Prefabricated components: cowling, fuel tanks, wheel pants, maingear and nosegear struts, strut cover and nosegear box.
Send SASE with 3-oz postage for brochure.

COWLEY ENTERPRISES, Bx 14, Santa Paula, Ca 93060, (805) 525-5829.
Plexiglass canopy.
H.C. COMMUNICATIONS, Bx 2047, Canoga Park, Ca 91306, (213) 882-0422.
Custom COM & NAV VHF antennaes.

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with	Take off	850 ft
150-hp, fixed-	Climb	800 fpm
pitch prop, gross	Cruise	150 mph
weight.	Full Aft stick	49 mph
Standard VariViggen	Landing	500 ft
Performance with 150-hp.	Climb	1000 fpm
Special Performance Wings	Cruise	158 mph
Specifications	Canard Span/Area	8 ft/18.3 square feet
Standard VariViggen	Wing Span/Area	19 ft/119 square feet
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications	Wing Span/Area	23.7 ft/125 square ft
Special Performance Wing	Gross Weight	1700 lb

PROVEN DESIGN Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43

kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS:
AIRCRAFT SPRUCE & SPECIALTY CO, 201 W. Truslow,
Box 424, Fullerton, Ca. 92632 (714) 870-7551.
VariViggen spruce kit, plywood kit, hardware,
aluminum and fiberglass. Catalog cost $2.

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton,
Ca. 90680 (714) 898-4366.
VariViggen prefabricated components: all machined
parts. Catalog costs $2.

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave, Dayton,
Oh 45424.
VariViggen plexiglass canopy.

MONNETT EXPERIMENTAL AIRCRAFT, INC, 955 Grace St,
Elgin, Il 60120 (312) 741-2223.
VariViggen molded fiberglass parts.
GOUGEON BROTHERS, 706 Martin, Bay City, Mi 48706.
VariViggen 105/206 epoxy and 403 fibers for wood
construction.

GEORGE EVANS, 4102 Twining, Riverside, Ca 92509.
VariViggen welded nose and main landing gear, 1-1/4"
sq. steel tube.

BILL CAMPBELL (VariViggen builder), Box 253, Phelan,
Ca. 92371
VariViggen prefab brackets and fittings.

JESSE WRIGHT (VariViggen builder), 7221 S. Colorado
Ct, Littleton, Co 80122.
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot

report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price: $4.75 per year first class mail, $6.50 air mail overseas. Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing; 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described. Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles. Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price: $4.75 first class mail, $5.50 air mail overseas.

VARIVIGGEN CONSTRUCTION MANUAL Part 1 of a photo-illustrated construction manual, written by Jim Cavis, S/N 31. Includes fuselage, canard, inboard wing, vertical stabs, control system, and landing gear, along with approximately 100 photos. Part 1 also includes helpful sketches on jigs and numerous building tips. The written information

is similar to plans chapter 5, except expanded to about 30 pages.
Price: $18.50 first class mail, $20.50 airmail overseas.

THE CANARD PUSHER NO. 15 JAN 78

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Mojave, Ca. 93501
(805) 824-2645

NEWSLETTER SUBSCRIPTION - $4.75 per year
OVERSEAS (AIRMAIL) - $6.50 per year
BACK ISSUES - $1.00 each

If you are building a VariViggen you must have newsletter 1 through 15. If you are building a VariEze you must have newsletter 10 through 15.

RAF ACTIVITY since the October '77 "Canard Pusher" has involved work on two new prototypes, new flight tests with the VariEze prototype - N4EZ, work with NASA on their VariEze evaluation and on the skewing AD-1, further evaluation of our solar water heater, builder support, a construction workshop, and preparation of "Section IV" (2nd edition) and "Section IIC" (Lycoming).

Those of you who are EAA members have already seen the Quickie in the January '78 "Sport Aviation." It is being developed as a joint venture by Burt Rutan, Tom Jewett and Gene Sheehan. Due to the large amount of time involved in supporting the VariEze program, Burt does not plan to market any new homebuilts in the foreseeable future; thus, after design freeze on the Quickie this spring, Burt and RAF will become inactive on the Quickie. It will be marketed as a complete kit (with engine) this summer by Quickie Enterprises, a new company formed by Tom and Gene. If you desire Quickie information beyond that in this newsletter, contact them, NOT RAF. They will stuff your self-addressed, stamped envelope with a Quickie flyer, or will provide a complete info kit for $6. (Quickie, Box 786, Mojave, Ca 93501.

The other project in our shop is still under construction and due to fly in April. It is RAF model 40, a light twin being developed for Pug Piper. He plans to certify and manufacture it within the next four years. Pug headed Piper Aircraft until 1974, then joined Beechcraft where he managed the group that developed the new Beech Model 77.

Our homebuilt solar water heating system has been in operation at RAF for about nine months now. When it has successfully demonstrated one year of operation we will be offering plans, and materials will be available at VariEze distributors. It is a very low-cost system using many of the techniques and materials used in the VariEze. It is designed to provide about 70% of the household water heating energy requirements at a cost of a small fraction of currently available units. Please do not inquire yet, but look for it to be available this spring or summer. Announcement will be made in the "Canard Pusher."

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Clarance Langrond - first EZ in Texas (Austin)

Quickie prototype

NASA eval of N4EZ (Don Hughes, Phil Brown, Jim Patton)

AIRFORCE TO USE VARIEZE - Burt Rutan gave a series of canard design seminars to the Air Force Flight Dynamics Lab at Wright Patterson Air Force Base, Ohio. We just recently heard that they are now having a VariEze built to use as a flight test platform for some RPV avionics. It will have a pilot in the back seat and a lot of test gear in front.

CANADA VARIEZE APPROVAL - A seminar was held in Toronto, 1 December 77 to 3 December 77 for the purpose of evaluating inspection criteria for homebuilt inspection criteria for homebuilt composite aircraft. Attendees included Canadian D.O.T. management and inspectors from each of Canada's regional inspection offices. Presentations on composite structural design and inspection were given by Larry Haig (American Eaglet) and Burt Rutan (VariEze and VariViggen SP). Inspection discussion periods were held and workshops were given in which the inspectors were given first-hand knowledge of what is a good and bad part. This is something we would like to see in other countries!

We were pleased to see NASA's general aviation research activity take an interest in the stall/spin characteristics of the VariEze. Last November NASA Langley, sent pilots Jim Patton and Phil Brown and engineer Don Hughes to RAF to do a flight test evaluation of N4EZ. Their debriefing was positive. We look forward to seeing their formal report. Since their evaluation, NASA is going ahead with very comprehensive research including building two VariEzes, one for full-scale wind-tunnel tests and one for flight tests. They also plan small scale, spin tunnel tests.

The workshop on 18 December '77 at RAF was well attended by approximately 110 VariEze builders and guests. VariEze construction methods were detailed, and the beautiful weather allowed flight demos by the VariEze and Quickie.

VARIEZE CLUBS/SQUADRONS - Now that 25+ EZs are flying there is more interest in clubs. The following are new ones; see previous newsletters for others.

Omaha - Jud Bock, 11029 Franklin St., Omaha, Ne. 68154

Idaho - Kieth McIntyre, 923 1/2 Kenneth, Moscow, Id. 83843 (208) 882-4070

Ohio, In, Mi, Il, Mo - Paul Sunday, 666 Tyler, Peru, In 46970 (317) 472-1521

New Jersey - Lee Herron, 1480 Pleasant Valley Way, #12, West Orange, NJ 07052 (now has helpful newsletter, plans an EZ flying Jun 3-4, 78.)

Buffalo - Don White, 54 Columbia St., Hamburg, NY 14075 (716) 649-6137

ENGINES - "Section IIC," Lycoming 0-235 installation for VariEze is now available. We were almost two months late on this due to late arrival of documentation from Air Sport and to some redesign being required.

N4EZ now has nearly 300 flight hours. Its 0-200A has 1500 hours since major overhaul. It has required no maintenance besides oil changes since it was installed in N4EZ two years ago. It rarely requires more than two flips to start. Oil temperature runs at 170 deg F. Cylinder heads run 420 degrees in a long climb, 360 degrees at cruise, and do not exceed 300 degrees on a continuous hot-day ground run. It has never had a starter while on N4EZ and its alternator was removed a year ago. These two holes were covered with 3/16" aluminum plates. My logbook shows that the starter failed twice on the previous owner and the alternator once, costing him over $400! As you know starters are not recommended on VariEzes. Only one has flown with a starter and that builder has since removed it. About 1/2 of the EZs to initially fly with alternators have removed them also, to reduce weight. We strongly recommend that you first fly without starter and without alternator. Add them later if you desire but do initial flying as light as possible. Do use a carb accelerator pump or primer for easy starting.

The following is a quote from Warren Curd, Raytown, Mo: "I originally had full electrical - the airplane flew well enough, but I had to carry weight in the nose, then when I started adding weight in the passenger seat I was less than satisfied. I finally took your advice and removed the starter, alternator, two solenoids, 22 ft of 1/0 cable and heavy battery - weight reduction 65 lb! The airplane now flies and handles so much better, I hardly can believe it. TO & Ldg speeds & distance are greatly reduced, climb improvement is amazing -- take it from me, save yourself a lot of work later - don't install a starter or alternator in your Eze. Starting is easy and the trickle charger keeps the small battery sufficiently charged for radio needs."

One Eze flyer experienced sufficient clogging of his fuel filter at 35 hr to affect engine operation. The "Owners Manual" 1st edition recommended inspection at 50-hour intervals. We now recommend 25-hour inspections. In addition, check it after the first five hours for fuel tank contamination. If you are using the VA6 filter, replace, rather than clean, the element. One builder substituted a drain-equipped gascolator for the filter and drain, as he was concerned about the filter's ability to pass water. We know of no water related problems, but don't see anything wrong with his modification.

Some builders are reporting that their Westburg tachs don't function correctly - be sure you have the right model number - it should have an "M" on the end (for magneto). If yours doesn't operate I'm told you can send it with $2 to Westburg for modification.

MUFFLERS - N4EZ has been flying with mufflers since October. It has undergone modification to increase power, however net performance loss, due mostly to the aerodynamic drag of the large bumps on the cowling, is about four to five mph. The most disappointing news is that the net lowering of sound level is less than hoped for. The engine exhaust

noise is reduced substantially, but the prop noise and canopy air leakage is still there, making the Eze still louder than the average lightplane. Measurements taken at the front seat are shown below: Back seat, is one to two db louder.

VariEze no mufflers	75% pwr	98.5 db
VariEze mufflers	75% pwr	96.5 db
VariEze no mufflers	50% pwr	95 db
VariEze mufflers	50% pwr	93.5 db
Cessna-150	75% pwr	93.5 db
Piper PA28-140	75% pwr	91 db

Based on this data we have not yet decided to pursue production of the mufflers - we would like to hear from you builders to see if you would be willing to pay the cost, weight and performance penalty for this much reduction in noise. Let us know.

ROSENHAN WHEELS & BRAKES - Good news - the modification designed by the manufacturer has been tested by Lee Herron on his VariEze and he reports the new brakes are excellent. They use the same piston size as the Clevelands, do not require adjustment and are no longer "soft" as were the original ones. All brakes delivered after November '77 have the new direct-action calipers. If you want to update your original triangle-block type brakes, you can get a modification kit at VariEze distributors.

The previous Rosenhan brakes were supplied with neoprene O-rings which were supposed to be compatible with aircraft or automotive fluid. Fred Rosenhan has told us that some may swell with certain types of fluid. The new brake retro-fit kit has aircraft type O-rings and extra ones to change your master cylinders. If you experience swelling with the old type write Fred Rosenhan, 810 E. 6400 S, Salt Lake City, Ut 84107 to get a replacement of aircraft type O-rings.

STALL CHARACTERISTICS & CG - Bill Rogers has reported less desirable stall characteristics than N4EZ's. Specifically, his airplane would depart into a snap roll if aggravated with rudder at full aft stick, and could enter a very high angle-of-attack deep stall. This stall was easily recovered with forward stick. He flew his airplane to RAF; we installed some nose weight and he repeated his tests. This time his Eze responded similar to N4EZ at aft cg. Until we confirm his cg by an accurate weighing (he did his on bathroom scales) we must assume that he was aft of the aft cg limit when he discovered the undesirable traits. We recommend that you avoid the last inch of the cg range until you are well familiar with the stall characteristics of your airplane and know that your weight and balance is accurate and current.

VARIEZE PERFORMANCE - In an earlier "CP" we told you the rpm data supplied was in error. We have calibrated a backup tach and remeasured this data. See below. Note that Cassady has reduced the pitch on his VariEze prop to make it turn faster to help takeoff and climb.

Seal cowling leaks around the fuselage, exhaust and aileron tubes. Air leaks here slow the airplane and reduce cooling. Canopy air leaks can also reduce performance.

Your owners manual shows most data vs. density altitude. Add the chart shown below to determine this. The new 2nd edition of the "Owners Manual" has refined data based on N4EZ tests with wheel pants, and data supplied by homebuilders. In addition to cruise data it has full throttle speeds vs. altitude, allowing you to directly compare your Eze to N4EZ.

Recently we obtained an accurate fuel flow totalizer to better define actual inflight mileage. The results of these tests show that, due to the poor fuel specifics of the 0-200 at low power, the "Owners Manual" data is incorrect except at high speed. Cut out the graphs shown below and paste them in your owners manual to correct this (2nd edition has blank pages in back). The climb-fuel used-chart is handy for flight planning. All cruise data are for lean mixture, 25 degrees F on rich side of EGT peak. Our tests show that at 9000 ft, full rich mixture results in 21% decrease in range at 180 mph and 30% decrease at 110 mph! Even 25 degrees F extra richness (0.1" motion of mixture knob) causes 5 to 6% reduction in range.

GRAPHS AND CHARTS OMITTED

CP15, Page 3

CONTROL SYSTEM ROD ENDS - The HM3 rod ends used in the control system are susceptible to being damaged if you do not use care in installing them. When adjusting the pushrod under the front stick be sure the normal stops in roll are reached before a twisting load is applied to the rod end. Be careful to not bend the rod end threads. If an HM3 has been bent, twisted, damaged or overloaded in any way it must be discarded, or used in a noncritical area (landing brake for example). Check your rod ends, particularly in the pitch system where they are non-redundant - if they are marked HM3C return them to be replaced with HM3. The "C" is a commercial grade and is not as strong as the aircraft HM3.

This is the epoxy pump discussed on page 9. **PHOTO OMITTED**

CP15, Page 4

COMPOSITE STRUCTURE - It is evident from looking at some of the parts we've seen, that a few of you, including some inspectors, do not adequately understand the inspection criteria. We have even seen some parts that need repair to meet the criteria, yet they were passed by FAA. DO NOT assume that just because FAA signs it off, it is okay. DO assure yourself that you can judge a part to the criteria in "Section I," "Section V," and newsletter 10. Also, be familiar with the clarifications in the other newsletters. Some more follow:

Bump/Joggle/Dip Criteria - The best way to check this is to lay a 12-inch straight edge on the part spanwise. Move it all over the surface in the critical areas. If you can see 1/16" gap in any area, the part

must be repaired. It is best to repair or beef up lumpy areas even if they meet this criteria. Better yet, do a good job in core preparation and use your squeegee well in the lay up to avoid the lumps in the first place.

Dryness Criteria - Pick any 6"x6" square in the lay up in the critical area. Assess carefully if any evidence of air in the lay up is present (white flecks, bubbles, air at the foam face). If the dryness evidence is more than 10% of the area, the part MUST be rejected. Reject or repair any evidence of dryness or voids in the trailing edge or leading edge overlaps. Better yet, do an adequate inspection with good light before cure when it's easy to fix. If in doubt on overlaps be sure to stipple in enough epoxy.

The following is a listing of the "critical areas" - the portions of the VariEze that must meet all the inspection criteria:

1. Center section spar - entire outside skin and spar caps.
2. All portions of the fuselage within 10" of the engine mounts and canard lift tab attachments.
3. All control surfaces.
4. All flying surfaces in the shaded areas shown plus all overlaps at L.E. & T.E.

SKETCH OMITTED

Several builders have had flying surfaces warp or bend due to being poorly supported until fully cured. Do not hang or support them at each end for long periods as they may "creep" or slowly deform. Store them leading edge down with support in at least three places. Your surfaces can be better protected against "creep" if you post-cure them. Sailplane manufacturers do this by putting the entire airplane in an oven at 160 degrees F. You can do it as follows: After you have painted on the black primer put the wing/winglet or canard out in the sun - be sure it is well supported in at least three places along its span. At noon a black surface can reach 140 to 180 degrees F, giving it a relatively good post-cure. After the post-cure the structure is more stable for warping or creep. If you have a wing or canard that is twisted wrong, apply a twisting force in the opposite direction before and during the post-cure (weights applied to boards Bondoed or clamped to the surface can be used). Remove the force only after the surface has cooled. A 200-ft-lb torque (50-lb weight on a 4-ft arm) applied twice, once while the top surface is post-cured and once for the bottom surface, can twist your Eze wing or canard over one degree. The twist correction will be permanent and will stay as long as the surface remains cool (below the post-cure temperature). This is generally referred to as the heat deformation characteristic of the epoxy. If it is room-temperature cured only, it will soften above 140 degrees F. But if post-cured it will not soften until over 160 degrees F. Heat for post-curing or for intentional deforming can be applied by other means such as heat lamps, hair dryers or electric radiant heaters (household type), however this is generally not recommended, since it is too easy for the homebuilder to get the part too hot and ruin the part. The blue foam is damaged above 240 degrees F. If you want to use these heat sources, do so by applying the heat very slowly and checking the temperature often by placing your hand on the surface. If you can hold

your hand on the surface five seconds without pain, the temperature is okay - three seconds is too hot.

Most people think the relative incidence of the two wings, set in chapter 8 is permanent, with no adjustment. This is not true. Several builders, on our instruction, have used the heat deformation method to straighten wing incidence on a completed airplane as much as one degree to correct a poorly trimmed airplane. Do this as follows: Attach a board as shown to the wing to provide a 600-ft-lb torque in the direction desired. Cover the wing root with corrugated cardboard to insulate it to protect the blue foam. Using hair dryers or radiant heaters* slowly warm the center-section spar (three or four sides, depending on if fuel tank is on), continually checking the surface for correct temperature (at least five seconds to pain). Heat it uniformly from the wing fitting to the fuselage. Let the spar completely cool before removing the weights. Recheck incidence to see how much it changed - don't overdo it the first time, use only moderate heat until you see how much will be required. **SKETCH OMITTED**

Creep is rare on the main gear since this part is post-cured. However, the main gear is subjected to a continuous high stress over long periods when the airplane is parked. This stress can be greatly relieved if you lift under one wing and allow the gear legs to spring together, then set the airplane back down when you park it. It is doubtful if gear creep will be a problem with the Eze, but if you do notice creep (gradual spreading of the gear) it can be reset by pulling the wheels tightly together with a rope (weight off the gear)

* Do not use heat lamps - they can create hot spots.

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heating then cooling the strut, then removing the rope. Another handy use of the heat deformation method is setting toe-in. If you need more toe-in, clamp boards on the wheels as shown, heat, then cool the strut, remove the boards and presto - toe-in that's easier than installing shim plates! **SKETCH OMITTED**

VARIEZE BUILDING HINTS - In order that you don't later overlook these, jot them down in the appropriate places in your "Section I." Same goes for building hints in other newsletters.

A builder has suggested a better method than the one shown in newsletter 13, pg 5, for building the eight glass pads in the wings and centersection spar at the wing fittings. The following method gives a wet bond of the pad to the wing fitting, saves a separate cure, and allows you to trim and round the pads at the sides, in-place on the fittings. First, measure dimension "A" to be sure it is .012" times the number of plies to be laid up in the pad. Dull the wing fitting, lay up the pads with excess hanging out the sides, no voids at front and back. Apply peel ply, then Saran Wrap (plastic release), then the block (overlapping the foam to assure a perfect transition from foam to pad), then the weight and let cure. Be sure to remove the peel ply and round the corners before the shear web is laid up. **SKETCH OMITTED**

Do not use a rod to align the CS2 brackets on the elevators. They can be as much as 0.1" off and a rod will still slip through and rotate freely. If you have done this, check by sighting or stringing a tight fine wire down the middle of the holes. The CS2 brackets must be repositioned if they do not meet the 1/16" alignment tolerance.

There has been some confusion on the sequence of applying the BID-wrap on the main gear. Lay the gear leg leading edge down on three blocks. Sand its surface and round the T.E. Apply one ply BID at 45 degrees. Cure. Turn over and apply 1-ply BID at 45 degrees. Now mount the tabs (step 2 & 3) then the brakelines (step 4). When glassing over the brakeline fill the adjacent void with dry micro. **SKETCH OMITTED**

We have been flying a different yaw trim knob on N4EZ that provides a finer adjustment, but eliminates the parking brake feature. This is optional; use it if you wish. Unless you can find some left-hand thread rod, it works backwards, i.e., turn it right for left trim. **SKETCHES OMITTED**

Many are still spending too much time in the layups. If a lay up takes over twice the time shown in the plans YOU ARE DOING SOMETHING WRONG and are probably not doing a good layup. Try this - instead of bringing in small amounts of epoxy to stipple in with a brush, pour the epoxy on the surface and make MANY LIGHT PASSES with a light squeegee to move the epoxy into the cloth. The squeegee can be the thin plastic from a coffee can lid. You can cut two 4-inch squeegees from the plastic cover of a 3-lb coffee can. It is easy to tell if the layup is too wet - pass the squeegee across the part then stop and lift it. If the lay up is too wet there will be a "lump" of epoxy where the squeegee stopped. Be sure resin is not colder than 75 degrees F. Using this method of going too rich, then squeegeeing the excess out gives less chance of trapping air. You will find this method works so fast that it is paced by measuring and mixing epoxy, so be sure to have one person who only does the mixing. Do a thorough job of inspecting for dryness, bubbles, overlap, imperfections, etc., and have someone else check it, too, before you leave it to cure. It's a shame to have to reject a part that's dry when it could have been fixed before cure.

Before glassing canard or wing bottom put masking tape below the knife trim line on the leading edge. This keeps epoxy off the foam on the top surface. A few pieces of 2"-thick, 2 ft-square foam rubber are handy to support wings and foam cores so they can be handled and worked on, without damage. Sticking nails into the leading edge of the wing cores at the W.L. at tip, root and mid-span will help in eyeballing the leading edge straight. Thanks, Duane Solberg, for the above hints.

Nat Puffer discovered that the canard bolts can be reached through the nose access door without need to reverse the bolts. He also suggests routing pitot line around, rather than under, battery to eliminate moisture trap.

Bob Gentry suggests adding 2" to the height of all wing jig blocks to give room to reach under to clean off micro.

Jim Smith reports a Sears model 315.17381 router is handy for recess cuts, rounding longeron edges and, set at zero depth, it removes excess

residual micro spots on foam and joints without cutting adjacent foam surfaces.

Make a drill jig as shown to accurately drill the hole through the outside pads of the main gear tabs. **SKETCH OMITTED**

CP15, Page 6

FLIGHT SAFETY - Most operational problems occurring with VariEzes have been due to not following the information provided in the "Owners Manual." It is disappointing to see someone fail to succeed solely because he overlooked or elected not to follow "the book." We do get questions from those who want to modify or exceed the limitations in the "Owners Manual." Our recommendation is to first follow the book; then if you desire, expand your envelope professionally to suit your needs, but DO NOT EXPECT SUCCESS, unless you follow all "Owners Manual" recommendations. Be sure you have completely updated your manual and checklist to include all newsletter additions (fuel system, ailerons, etc.) or buy the 2nd edition. Carry the book in your airplane. USE your checklist.

QUESTIONS - When writing RAF with an individual question please remember we can answer only those accompanied with a self-addressed, stamped envelope. If you're outside the U.S. you can substitute an international postal coupon (available at your post office) for the stamp.

Q. Can I use Scotch Brite dish pads to dull the fiberglass for a future layup?
A. No, use only 36-grit or 60-grit sandpaper. Better yet, plan ahead and use peel ply. We've noticed that many builders are not using peel ply for winglet attachment. Be sure to peel ply the outboard 18" of the wing and the lower 14" of the winglet.

Q. After installing the optional landing brake my left suitcase doesn't fit - what now?
A. Trim the stiffener from the suitcase front and cock its nose inward about 4".

Q. Can I hinge the instrument cover for access?
A. No, the piece behind F28 is structural and must be glassed in place as shown to aid fuselage stiffness.

Q. I hear different numbers - how much does it cost & how many man-hours to build an Eze?
A. This info is based on what we hear from builders. Those who buy all available prefab parts spend about $4900 + engine and average 900 man-hr. Those who build most everything spend about $3000 + engine and average 1400 man-hours. Minimums we've heard of are $2400 + engine and 580 man-hours.

Q. Instead of the separate fuselage fuel tank can I make my aft fuselage compartment into a fuel tank?
A. Yes. Several have done this, saving work and weight. The inside of the compartment must be laid up wet, like the wing tanks. The cap, outlet, screen & vent are installed similar to the wing tanks. The

tank must have a bottom as shown to allow wing tank vents to pass under & to avoid leaks at the center section spar bolts. **SKETCH OMITTED**

VARIEZE PLAN'S CHANGES - Be sure to copy these into your plans now.

OWNERS MANUAL (1st edition only) page 40	Change 50 hr to 25 hr. Add "replace element if VA6 filter is used."
OWNERS MANUAL 1st edition pg 20 2nd edition pg 19 also VariViggen Manual pg 16	Add "stall characteristics have been found to vary from airplane to airplane, particularly at far aft cg. Avoid the last one inch of the cg range until you know the stall characteristics of your airplane and know your weight and balance is current and accurate. Recovery controls for any unusual characteristics at high angle-of-attack are stick forward and rudder against any rotation, (ailerons neutral)."
OWNERS MANUAL (1st edition only) pg 4	Add the following: The diagram below shows the motion of the nosegear handle to extend or retract the gear. The handle is locked in the lowered position for gear up or down. Do not force the handle downward unless it is fully forward or fully aft. **SKETCH OMITTED** If the handle is forced down repeatedly this can bend the tube with the result that the down lock "snub" is lost. Be sure to check that the required one-inch snub is available. (Pg 17-10 of "Section I").
SECTION I Pg 17-10 & pg A-1	Revise the slot for the nose gear as shown below (straight slot). Fabricate the parts shown below and install as outlined on page 7 of newsletter 14. This eliminates the sideways motion of NG10, allowing NG11 to remain firmly in the extreme locations of NG13 guides. If NG11 is not fully into the extreme travel of NG13's on both sides, the nose gear may come out of its lock during taxi. **SKETCHES OMITTED**

SECTION I Pg 18-1	Ignore dimensions on landing gear tabs. Substitute those shown below. If you have fabricated these check to be sure you are not short on the 0.85 dimension. **SKETCHES OMITTED**
SECTION I	Beef up of landing gear attach tabs shown

Pg A-5 & pg 10-3	in newsletter 12 & 14 has required that some material be removed from the main gear strut to correctly fabricate the tabs. To avoid this, move both forward extrusions forward 0.2" and move both aft extrusions aft 0.2". Each extrusion set should be spaced 5/8" apart. (Initial fabrication only, retrofit is not required). Do not lay up pads on wax paper.
AILERON ADDENDUM page 5	Drawing on right side - 9-3/4 should be 9-1/4.
AILERON ADDENDUM page 9, Bill of materials	Add "6061-T6 can be substituted for 2024-T3 on the 3/4" tube.
SECTION I pg 15-1	3.7 should be 2.7
SECTION I pg 6-7	Section A-A trough should only be 8" long on bottom of wing. Use the full 10" for wing top. Use care to not undercut this area. On glass dimensions, increase the 58" dimension (UND spar cap) to 62" and increase the top UND spar cap from 62" to 66" (page 6-11). New construction only, retrofit is not required.
SECTION I pg 4-2, 6-1, & 7-1	Add "Be sure to use the method shown at the top right of pg 7 of newsletter 12. This will assure a straight leading edge. Hotwire L.E. wire
SECTION IIA & IIC	Add "mixture and throttle controls must operate smoothly without free play, lag or excess friction. They must snub against idle and full positions. Check this before running the engine."
SECTION I Pg 22-8 &	Reference the canopy opening occurrences described in newsletter 14. A builder has suggested a car-hood type secondary latch system that doubles as an engagement point for the canopy key lock. To open, use key to rotate lock arm vertical. Then raise canopy 1.5" and push in on the latch. I haven't installed this but it looks like it would work fine. **SKETCHES OMITTED**
OWNERS MANUAL Pg 40	In annual maintenance section add "Jack or lift the weight off the wheels and measure the spread of the main gear. If it's more than 56 inches at insides of strut at axles, move it inward using the method in newsletter 15." (see page 5). **SKETCH OMITTED**

SECTION I Pg 6-14 & 6-15	The waterline on template Y/B and the straightedge of jig block F are at an incorrect angle by about 0.7 degrees. This error was noted in newsletter 11, and builders were told to shim F to get straight leading and trailing edges. Most builders have done this, taking the correct approach of making the root & tip waterlines parallel and shimming to get a straight L.E. & T.E., thus getting a straight wing with the correct twist. However, some did not notice the note in cp 11, and have questioned us on the jigging method. To avoid confusion, correct the waterline on Y/B and F as shown, by raising them 0.27" at the trailing edge. They are correct at the leading edge. Now, if the jig blocks are mounted on a flat table, the L.E. & T.E. should be straight. **SKETCH OMITTED**

SHOPPING - Good news. Several of the items we have been trying to get on the market are now defined, tested and ordered by the distributors.

EPOXY PUMP - marketed by Aircraft Spruce & Wicks. This is the same pump we've been using at RAF for the last year. It dispenses the correct ratio of resin and hardener into a single cup. It is a well-built, industrial quality unit. It saves a lot of epoxy since you can make small batches if desired (the balance scale is not accurate below one-two oz.) It can save about 5-10% of the man-hours required for a layup. It should be durable enough to last for years of continuous use.

SOLAR PANEL - We have finally been able to get a manufacturer to build a solar charging panel for our application at a good cost. It is only 0.1" thick, weighs 0.6 lb, measures 9"x12" puts out 4 watts, and retails at Aircraft Spruce & Wicks for about $119. This panel can be bent into a gentle curve for mounting on the Eze nose.

PLACARDS - Aircraft Spruce is developing a complete set of metal placards for your Eze cockpit. They have a special sponge-type adhesive that adheres well to a fiberglass surface.

SPINNER - Aircraft Spruce now has a spinner specifically designed for the VariEze. It has been in test on N4EZ for the last three months. Previous spinners have suffered cracks after a few hours. This one has two very stiff flanges that accurately fit the cone. It has a long, pleasing shape, is 10.3" diameter, and comes complete with forward airflow guide for best engine cooling and low drag. I had given up on spinners until this one worked out so well. Specify engine type and prop hub thickness - the flange is custom trimmed.

4-PLY TIRES - Wicks and Aircraft Spruce are now stocking 4-ply main tires for the VariEze. They are lighter but stronger than the 2-ply

slicks. They have a fine tread that will not pick up large rocks. They should be operated at 65 to 70 psi pressure. I am using these now on N4EZ.

RUDDER & PITCH SPRINGS - Aircraft Spruce is now stocking custom-made springs for VariEze pitch trim and for rudder return.

PREFAB WINGS/CENTERSECTION SPAR - Jiran is currently completing tooling to produce VariEze wings and C/S spars. The design is somewhat different than the plans, in that a long tongue with two pins is used in place of the current metal fitting. This allows incidence adjustment. The wings will have a sailplane-like finish. They will be flight tested on an airplane built by Jiran for that purpose. That airplane will be sold after tests are completed. Anyone interested in it should contact Jiran.

"I FLY A VARIEZE" SIGN - Cowleys is making an attractive plastic magnetic sign - contact them if interested.

FOR SALE - A75-8.G. Layton (213) 894-3979.

FOR SALE - VariViggen wingfitting set, Lynn Pilkington, 140 S 1st W., Hyrum, Ut 84319, (801) 245-3805.

MATERIALS SUBSTITUTION - Those of you who receive "Sport Aviation" may have noticed an article in the January issue by Hans Neubert inferring that VariEzes could be built from commercial weave 181 and 143 fiberglass and any one of a number of commercial epoxy systems. Particularly disturbing was the author's inference that our distributors were merely pouring the low-cost, highly-toxic 815 resin into containers with a different label. We are not concerned that VariEze builders are being misled, as they have been kept aware of the reasons we had to resort to special formulations and cloth weaves. "CP" 10 (Oct '76) describes the problems we encountered trying to use 181/143 cloth and attempting to use Shell 815 resin systems. It also describes our fight to reduce the materials' cost. As we discussed in "CP" 12, development of the resin/hardener system after the first vendor went out of business, was a difficult, time-consuming task. This required five months of testing over 20 different formulations from three different vendors to develop a system that would meet our requested specifications of (1) min SPI of II, (2) heat distortion, (3) odor, (4) room temperature physicals, (5) fuel and foam compatibility (6) moisture absorption (7) cure time at 65 degrees and 95 degrees (8) exotherm with micro mix, in insulated foam core, (9) mix ratio, (10) viscosity, and (11) shelf life. It is of interest to note that one of the larger formulators in the Los Angeles area was unable to develop a system to simultaneously meet the requirements, and Applied Plastics required over a dozen different system variants to arrive at the solution. I have asked Applied Plastics, the RAE formulator, to respond to the Neubert article. Their comments follow:

"I believe it to be fairly well known that in early 77 the R A resin system was changed from the "Lambert Blend" to epoxy resin and hardeners manufactured by Applied Plastics Co. Inc, 612 E. Franklin, El Segundo, Calif. Applied Plastics is a resin manufacturer supplying the aircraft and aerospace industry world-wide and have been manufacturing chemical intermediates for more than twenty-five years.

Explaining the varied technical capabilities, unique abilities of our chemists and our extensive quality control department would be time consuming and may indicate an attitude of DEFENSE while to the contrary we are offensively incensed by this article which in our opinion does not take sufficient regard for the personal safety of fellow EAA builders and of others who might follow these suggestions. The statement that R A resins after March are the familiar Shell Epon 815, only further substantiates our feeling that substituting resin systems without laboratory evaluation by QUALIFIED INDIVIDUALS can be extremely dangerous. Our laboratory testing showed the use of B.G.E.

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resins in this construction to cause extensive foam damage. Let me state here that Applied Plastics does not now, and never has, supplied Shell 815 or Shell 828 as R A resin. The cost comparison example which suggests you buy 828 by the drum is an extremely hazardous recommendation, in our opinion. The pages that address themselves to epoxy hardener substitutions are equally as potentially hazardous. The suggestion that would encourage a homebuilder to handle materials such as DETA and TETA are in our opinion reckless and unnecessary. The following hardeners were not usable because of the safety problems they represent; also our knowledge of working with these materials showed them to be too exothermic when used in foam cores with microballoons: AEP, TETA, SHELL U, SHELL T. Shell A was never considered as it is a system that requires heat curing and not too many have autoclaves or walk-in ovens, not to mention the added responsibilities heat-curing systems require to make good laminates. Shell T has been discontinued for well over a year. The chart which showed the above curing agents along with Versamid 140, which is a high viscosity material, and then suggested that you thin with toluene or alcohol can again produce a hazardous situation, hazardous when working with them as well as hazardous from the standpoint that you change the physical properties of the hardeners when you cut them with solvents. When solvents are trapped in laminates you will also get long term degradation of the laminate, and foam core damage. The development of the RAE slow hardener to meet the requirement of adequate cure and yet not result in exotherm damage deep in a foam core, required several months testing. More than a dozen different systems were tested, not merely to optimize the pot life but in fact to achieve a system that provided the homebuilder with a safe structure. Both the fast hardener and the slow hardener required numerous tests to meet the specifications. Often we would find material that would be excellent in all properties but then would fail to meet the all important heat resistance test. This requirement alone excluded most of the common base hardeners referred to in the article by Hans Neubert. Let me add that Applied Plastics sells most of its materials in drum quantities and would be most pleased to pass on savings through the distributors to builders who have the resources and the equipment necessary to handle five-hundred-pound drums. Finally, let me reiterate that from the beginning our intention was to provide safety and safety at a moderate cost; in our opinion the R A resin systems are sold at a very low cost for formulated systems."

I have invited Mr. Neubert to our shop for a first-hand demonstration of what happens when the VariEze layups are attempted with 181 and 143 cloth. While they perform nicely when used in vacuum bag operations they present unacceptable problems when used in most of the Eze hand-layups. We made many measurements of this when we originally attempted to use them. They can more than double some lay up times due to the frustration of chasing wrinkles and bubbles, they cannot be flagged for spar caps, they hide air making inspection more difficult and less reliable, they draw in air after a moderate pass with the squeegee, their ability to conform to compound curves is less than BID and UND, the difficulty in determining major fiber orientation leads to errors, and they require more resin to wet out for the inexperienced laminator, resulting in a weight increase.

Summarizing, we have spent a considerable amount of effort developing methods and materials to make it possible for the homebuilder to do what the aviation industry cannot yet do - that is, build a safe all-composite airplane. To allow the average individual to be capable of this task did require other than the commercially available materials. A VariEze with engine and radio will cost from $5000 to $10,000. Saving 3% of that by substituting unsafe structural materials is foolish.

VARIVIGGEN NEWS - (Be sure to note the "Owners Manual" addition shown on page 7 of this newsletter).

Another Viggen has taken to the air since "CP 14. Here are details from Harold Reiss.

"1st. flight C.G. was set up at 122.9" with a 180 lb. pilot, 15 gallons of fuel in the main tank and an empty weight of 1130 lbs. I had to add 47 1/2 lbs. of lead to the nose to get this C.G. location, so, other builders keep the tail end as light as you can without sacrificing strength, particularly if you locate the battery behind the front seat bulkhead, as I did.

Dec 27th runway taxi tests were somewhat limited. I had planned to do 4 or 5 runs down the runway to determine how it would handle, however the first nose wheel lift off at 47 indicated resulted in a somewhat mushy 1 to 2 ft. high flight. After putting it back on the runway, and while still rolling, I applied about 1/2 throttle to 52-54 indicated, retarded the throttle to idle to prevent further acceleration, raised the nose wheel and once again the mains followed and I found myself airborne at about 10 ft. Everything felt fine with the stick slightly aft of neutral and centered so I decided to go ahead. I applied about 1/2 throttle, climbed up to pattern altitude, left the gear down, and set up a normal approach. Had 20 degrees of crosswind at about 5 kts. and used diminishing power. The landing was a squeaker. There are no indications of any warps or twists in the flying surfaces so no trim tabs will be needed.

Thursday Dec. 29 - Actual planned first flight. Take off run was slightly long as I used only about 1/2-power and had about 18 kts wind at 190 degrees on runway 22 - crosswind control is excellent - flew the pattern with gear down and did a power approach landing which was again a squeaker and

slightly nose high. The nose fell through a lot slower than the first time and I taxied in to complete the T.V. coverage (six and 10 o'clock news) Then I decided another flight was the order of the day. I broke ground a lot quicker with full power at about 56 indicated and lowered the nose a bit. Speed build-up is very rapid in this airplane as it got to 120 ind. right now. Started up to pattern altitude, slowed to 80 - 95 and retracted the gear, nose wheel first, by using the panel breakers, and then the mains. The gear came up perfectly though I did notice a slight vibration after retraction. Got on downwind, slowed and selected gear down - there went the nose wheel down and locked, but alas no mains - shook the wings - still NO MAINS. I then cycled the circuit breaker for the mains and had NORMAL gear extension.

I suppose the breaker might have opened at a lower than 5 amp current draw during retraction and took that long to cool for reset, although I think everything was all the way up. During tests on the jacks I had checked the load electrically and found it to be 3.57 amps with no outboard load on the wheels. So far the airplane has about one hour of actual flight time on it and it feels really good. If we had some of your California weather instead of snow every day, the time on 29HR would build faster. I called Mike Melvill and we will get together for some photos when the weather is decent."

Mike has also had the main gear C/B pop. We are recommending that you change both main and nose breakers from 5 amp to 7 or 10 amp. Mike installed cabin heat per the instructions supplied with the cowl. He reports that it is very effective with more than enough heat. He has floor outlets in both cockpits and on the windshield.

Mike had a very harrowing experience with his Viggen at about 50 hr. Apparently due to a materials defect a 1 ft length of one exhaust pipe fell off and hit the prop causing 1/2 of one blade to separate. The resulting severe vibration made the wing tips invisible and set off the ELT. Mike shut down and made a forced landing in a field. No damage resulted except for prop and pipe. Mike was quite complimentary on the strength of his Viggen to hold up under this severe shaking. He replaced the defective part and installed a stainless "net" on the cowl outlet such that a reoccurrence would allow the tube to drop into the cowl rather than the prop. He also shortened his tubes to the same length as N27VV's. N27VV ran this exhaust system (in mild steel) over 500 hr with no indications of any type failure. Mike now has nearly 100 hr and plans to fly to the sun-n-fun flyin in Florida this month.

The accompanying photos show the progress of Dave Burdette's all composite canard for his Viggen. Also shown is Ken Guscott's winglet installation on a standard-shaped composite wing.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

VariViggen glass canard in jig.

Jim Smith, Dave Burdette

No! This canard goes on the Viggen, not the EZ!

Ken's winglets.

QUICKIE - The photos give you a good idea of its configuration. You EZ builders will find its structure very familiar, except that it has no wing fittings - its canard & wing are made in one piece & built permanently on the fuselage. We use the term "2/3 EZ" a lot, since it has about 2/3 the glass and epoxy of an EZ and takes about 2/3 the man-hours and cost to build. Its empty weight is much less than 1/2 the EZ's and it has only 16 or 18 horsepower! It will cruise comfortably over 110 mph and has good range. Burt did the initial 3-view in May 77. Tom, Gene and Burt worked on drawings and engine development during June and July. Construction started in late August 77. It was kept a secret from all but those of us at RAF until its first flight in mid-November. The airplane is described in great detail in Quickie Enterprises "Info Kit." Please do not call or write RAF for info on the Quickie - as Tom and Gene will be doing all marketing and homebuilder support. Those of you who will build the Quickie are in for a real pleasant surprise - this is one, fun airplane to fly!
PHOTO OMITTED

NEW RAF LIGHT TWIN - Shown in the adjacent artist's concept is our 4+2 twin under construction at RAF. It will be in a class by itself, in that it is a very basic airplane with few complex systems and is considerably lighter than the competition. Its 46-inch wide cabin is more comfortable and has 6" more leg room than current light twins, yet its overall size, gross weight, and wing area is much less. Its primary intended attribute is safety, in that it not only has no min-control speed, but will require no pilot action or configuration changes in order to climb when an engine fails. It is designed to even be able to climb at its minimum full-aft-stick speed, at gross, with one prop windmilling (not feathered) and with the gear down. A comparison follows. Note that the M40 has retractable nose gear only, no flaps and fixed props. Both airplanes have two 160-hp Lycomings.

	GRUMMAN COUGAR	RAF MODEL40
Seats	4	4+2
Span	36' 10"	28' 10"
Wing Area square feet	184	127.3
IFR Empty Weight - lb	2645	1525
Useful load - lb	1155	1375
Gross Weight - lb	3800	2900
Payload, Full Fuel - lb	459	835
Fuel, 4 Adults+80 lb Baggage - lb	375	540
Rate of Climb - fpm	1200	1600
Single Engine R/C - Gear Dn, Flaps Dn, Windmilling - fpm	Neg	280
Max Single Engine R/C - fpm	280	320
Cruise 55% - kt	149	181
Cruise 75% - kt	165	201

Range, 75%, Full Fuel, nm	1100	1045
Range, 4 Adults+80 lb Baggage - nm	593	1045
Stall, Ldg Config - kt	61	61

PHOTOS OF QUICKIE AND DRAWING OF MODEL 40 (DEFIANT) OMITTED

VARIEZE

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $2600 (less engine) in about 1000 man-hours, or from prefab parts and materials, costing approximately $4000 in about 600 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair. The VariEze uses the small four-cylinder Continental aircraft engines. The 0-235 Lycoming, stripped of starter and alternator, is now being tested and should be available soon. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 20 gallons of fuel. Frontseat passengers up to 6', 7"/250 lbs and backseat passengers up to 6',5"/220 lbs can be accommodated plus a modest amount of baggage in two custom suitcases. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (60 kt/70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance. THE TEST PROGRAM The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive

tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE HOMEBUILDER SUPPORT The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$94.00	$108.00
Section IIA	$19.00	$21.00
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95
Add 6% tax if Calif resident - newsletter is not taxable.		
*US. FUNDS ONLY		
TOTAL		

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

SECTION IIA - Continental A65, A75, C85, C90, 0-200

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS & PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP AT GROSS WEIGHT:

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	560 lb
Gross Weight	1050 lb
Range at Max Cruise	700 mi
Range at Econ Cruise	850 mi
Min Speed (full aft stick)	55 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6 square feet
Canard Span/Area	12.5'/13 square feet

SPECS & PERFORMANCE WITH 75-HP CONTINENTAL:

Take Off	1050 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	530 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGUES AND DESCRIPTION OF ITEMS.

AIRCRAFT SPRUCE & SPECIALTY CO. OR WICKS AIRCRAFT SUPPLY
201 W. Truslow Ave, Bx 424, 1100 5th St.
Fullerton, Ca. 92632 Highland, Il. 62249
(714) 870-7551 All Raw Materials (618) 654-2191
Catalog costs $2.

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680
(714) 898-4366.
Prefabricated components: wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder

pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, Bldg 6, Mojave Airport, Mojave, Ca 93501
(805) 824-4558.
Prefabricated components: cowling, fuel tanks, wheel pants,
maingear and nosegear struts, strut cover and nosegear box.
Send SASE with 3-oz postage for brochure.

COWLEY ENTERPRISES, Bx 14, Santa Paula, Ca 93060, (805) 525-5829.
Plexiglass canopy.
H.C. COMMUNICATIONS, Bx 2047, Canoga Park, Ca 91306, (213) 882-0422.
Custom COM & NAV VHF antennaes.

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If you are building a VariViggen you must have newsletter 1 through 15. If you are building a VariEze you must have newsletter 10 through 16.

RAF ACTIVITY since the January 1977 newsletter has involved finishing the test program on the Quickie, construction on the M40 twin, homebuilder support, further evaluation of our solar water heater, consulting on the AD-1, and further flight tests with our VariEzes.

QUICKIE - The Quickie finished its very thorough flight test program on 14 April 78, five months after first flight. Although the Quickie flew well on its first flight it underwent some configuration modifications during its test program. These included an increase in aspect ratio and span of both the canard and wing, and modification of its ground attitude to optimize takeoff and landing qualities. Its flight test program, conducted at RAF, was done jointly by Tom Jewett, Gene Sheehan, and Burt Rutan. Gene did the majority of the construction work, Burt the design definition, Tom the drawings. All three shared test pilot duties with Burt doing all envelope expansion except the last two spin-attempt flights. Peter Lert flew the last spin attempts - he had done the VariEze spin test two years ago. Tom and Gene have now formed Quickie Aircraft Company, Inc. and plan to have the Quickie kit on the market before June. Their address is Building 68, Mojave Airport, Box 786, Mojave, Ca. 93501. Please contact them, not RAF, for any information on the Quickie. Two aviation writers have now flown the Quickie. Their articles will appear in the June issues of "Air Progress" and "Flying" magazines. Some interesting facts about the Quickie follow:

Maximum sea level speed is 126-mph, cruise at 75% is 115 - This is over 6-mph per horsepower, a considerably higher ratio than any available airplane.

Even though the Quickie has only 18 HP it has no 'sink' or 'mush' on the back side of the power curve. When it is flying at full-aft-stick at 53 mph it 'bucks' or bobs its nose up and down. At this full-aft-stick condition it can maintain altitude at 10,000 ft and can climb 300 ft/min at sea level!

Its total wing area is about the same as the aft wing of the VariEze, 53.8 sq. ft., yet it can heft a 180-lb pilot and 20-lb baggage off the ground at 53 mph and fly him over 600 miles at 100 mph.

The Quickie is characteristically incapable of spinning; its high angle-of-attack flying qualities are identical to the standard-wing VariViggen - docile enough that the pilot does not hesitate to make very tight turns near the ground without fear of stall/spin.

The RAF hangar is located on the west end of the flight line at the Mojave airport, Mojave Calif, approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any part for our comments. We are normally open from 9 to 12 and 2 to 5 on wed thru sat, but you should call first to check, since with the fly-in season starting we will be gone a lot. We plan to fly N4EZ to the Chino, Watsonville and Oshkosh fly-ins and possible some others.

When writing to RAF always send a stamped-self-addressed envelope along if you have questions. If you are making an order, it's best to keep it separate from a request for an answer to a builder-question. Mark the outside of your envelope "builder question". This will speed our reply.

Peter Garrison landing N77Q **PHOTO OMITTED**

EZ's at Oshkosh **PHOTO OMITTED**

CP16, Page 1

MODEL 40 - Our light twin is now nearing completion, with engine controls, wiring and cowlings yet to be built. See "Canard Pusher" 15 for a description. Of particular interest is the airplane's estimated performance at light weights, i.e., one pilot and one-hour fuel. Weight for this condition is less than 1800 lb and weight-to-power ratio is only 5.6 lb/hp! At this weight we expect a climb of over 3000 fpm, 800 on one engine, with the other windmilling.

It is interesting to contemplate the impact on light twin safety that might occur with an airplane that has no large trim change and requires no pilot action at engine failure. Our design goal specifies absolutely no configuration changes or systems adjustment immediately required when an engine fails. Its throttles are combined into an unit that appears and feels as one grip, but is shaped to provide foreaft identification. Its fixed-pitch props dictate a normal cruise at 55% rather than 75% power, a wise fuel economy on all twins anyway. However, the 40 is expected to cruise over 10 kt faster at 55% than the competition at 75%, doing so at over 50% more miles per gallon! Of course, these are estimates at this point; we will know much more in a couple of months. The main reason we are telling you so much about an airplane that has yet to fly, is we need your help. We do not have a name for the Model 40 yet. So, we are having a 'Name the Plane' contest. Please send in your suggestions, addressing them to NAME THE PLANE CONTEST, c/o RAF, 13 Mojave, Airport, Mojave, Ca 93501. The winner will get a free five-year subscription to the "Canard Pusher." If possible the name should emphasize the safety, simplicity, or efficiency of the airplane, or its composite construction.

Please remember that the M40 was not intended for homebuilt construction. At this point it is considered only a proof-of-concept prototype. We are not in a position to answer questions about its future application. We will keep you informed through this newsletter of test results and future plans.

DID YOU KNOW??? That the VariEze on the cover of the April "Air Progress" is owned by Dianne and Lee Herron. They flew two hours of formation photo work to get the beautiful photos used in the article, but were not even mentioned in the magazine. Another unusual item about their coverage is that some very lengthy discussions of the VariEze's flying qualities were written by a pilot who flew one for only a few minutes and made only one landing. The managing editor of "Air Progress" has flown at least 20 flights in two different VariEzes including cross-country flights and spin attempts, yet printed no comments about his flights.

COMPOSITE INTRODUCTION PACKAGE - We are in the process of preparing an introductory kit for those contemplating building a VariEze, Quickie, or VariViggen SP wing. This will be a kit of sample materials (epoxy, glass, foam, peel ply, micro, cups, brushes, etc.) and a booklet describing the use of foam and glass in moldless aircraft construction and plans for several items to build with the sample materials. The purpose of the kit is to, at low cost, help you answer the questions: "Can I build a glass airplane?" or "Do I enjoy working with the materials?" The booklet contains all details about how the materials are applied in moldless composite sandwich construction. Also, detailed is information teaching you how to inspect for flaws and how to repair them. The kit will be available direct from Aircraft Spruce or Wicks (not RAF) about the first of June. Contact them at that time for price and availability (addresses are enclosed within).

VARIEZE/VARIVIGGEN CLUBS -
Lee Herron, Box 357 WOB, West Orange, NJ 07052, (201) 736-9092, has asked that Easterners planning to fly Ezes or Viggins to Oshkosh, contact him to arrange a formation flight, or pickup along the way. By the way, Lee has put light-weight Slick mags and removed the generator from his "Dragon Fly" Eze and reports, "The change in performance is fantastic. Climbs like a dragon with its @#$#% on fire!" He also is using an 0-200 carb on his C-90. Lee is planning a flyin on 3 and 4 June at the Essex County Airport.

Bernard Dodd, 193 Earlscourt Ave, Toronto, Ontario, CANADA M6E 4B2 (416) 651-2555 is EAA chapter 41 designee in composition structures, and is now organizing a Canada VariEze club/squadron. All Canadian builders contact Bernard; he can give you all valuable help with your projects; he attended the December 77 Canadian composite symposium.

CANADA APPROVES VARIEZE - The Canadian DOT has approved the VariEze for Canadian homebuilders. We would like to express our appreciation to the following individuals, and to others who worked so hard to organize the December 77 composite symposium: K.D. Owen, Chief Airworthiness, Inspection, DOT; W.E. Slack, EAAC Tech Committee Chairman; Eric Taada, EAAC, Ottowa, Ontario; Gogi Gogiullett, EAAC President; H.J. Bell-Walker, DOT; George Gibbons, Wicks Aircraft Supplies.

JIRAN MOUNTED CANOPY
Jiran reports that some of you are confused on the use of the mounted canopy assembly. The mounted canopy as supplied is located with the front of the glass frame at FS28. To do this you may have to remove some foam. The rear of the frame DOES NOT reach the firewall.

You may locate the mounted canopy any place on the fuselage should you wish to change the position of the transparent part to suit your particular needs for visibility, up to 2" forward of the position shown in the plans. Do not forget to install all inserts at the correct place to fit the hinge and latches on your fuselage, before glassing the inside. Be sure to clamp the frame to the correct width before glassing the inside.

Trim the rear of the frame as per your plans. The missing part between the mounted canopy and the firewall must be constructed by you into a fuel tank as per "CP" 16.

Cut the front of the frame as per the plans to provide the movable part of the canopy.

The section from FS28 to the movable part of the canopy may be used if desired, but MUST be glassed inside and glassed to the fuselage per the plans to provide fuselage stiffness.

If in doubt, follow "Section I" chapter 22 and make your finished canopy STRUCTURALLY IDENTICAL. The finished outside frame as received has the same number of plies as the plans.

SURVEY OF EZs AND VIGGENS NOW FLYING
We are often asked how many homebuilt EZ's and Viggens are flying and what has been their operational experience and performance. Since we do not have a complete list of this information, we are asking all of you now flying to fill out the form below. In most cases it will require you to do a flight to gather the performance data. The correct method to do this is outlined below. Be sure to send this to RAF especially if you have logged more than 100 hours, as we need this information for Australian homebuilt approval. The results of this survey will be printed in a future "CP" newsletter.

NAME_____date_____
ADDRESS_____
_____,_____,_____
Type: VariEze VariViggen (circle one), Tail Number N_____
Date of first flight _____
Flight Hours to date _____hrs
Pilots who have flown aircraft:

Name	Total Pilot Time	Total Eze Time

Engine type_____HP_____prop type/size_____
Circle equipment IF installed: NAV COM, transponder, attitude gyro, turn & bank, DG, alternator, starter, gear & canopy warnings, Cleveland wheels, Rosenhan wheels, solar panel, wheel pants, spinner, position lights, strobes, landing light, other _____
_____.
Finishing materials (state number of qt of feather-fill and qt of paint used) _____
Empty weight, ready to fly, no oil, no fuel _____lb
PERFORMANCE:
Take off distance_____ft @ _____lb weight, @ _____ft-density altitude (no wind, use lift off speed from "Owners Manual" 2nd edition, pg 43).
Rate of climb @ indicated 80 kt (95 mph), full throttle:
Rich mixture, @ 3000 ft, _____lb weight _____degree C OAT= _____ft/min.
Lean Mixture, @ 9000 ft, _____lb weight _____degree C OAT= _____ft/min.
SPEED:
(1) Full throttle, rich mixture, 2000 ft altitude
@_____lb weight, @ _____degree C OAT,=_____mph indicated
@_____rpm.
(2) Full throttle, lean mixture, 8000 ft, altitude
@_____lb weight, @ _____degree C OAT,=_____mph indicated
@_____rpm.
(3) Full throttle, lean mixture, 12000 ft altitude,
@_____lb weight, @ _____degree C OAT,=_____mph indicated,
@ _____rpm
(4) Partial throttle at 2000 ft altitude, 2200 rpm,
_____lb weight, @ _____degree C OAT,=_____mph indicated.
(5) Partial throttle @ 8000 ft altitude, 2200 rpm,
_____lb weight, @ _____degree C OAT,=_____mph indicated.
(6) Partial throttle @ 12000 ft altitude, 2200 rpm,
_____lb weight, @ _____degree C OAT=_____mph indicated.
Shortest field operated from has a _____ft long runway and is at an elevation of_____ft.
State any problems operating from short or rough fields.
_____
_____
_____.
Longest flight flown was _____miles, was cruised at_____feet altitude at_____mph indicated airspeed and resulted in_____mi/gal economy, at takeoff weight =_____lb.
State any modifications you have made to the basic configuration shown in the plans (as updated by "Canard Pusher" newsletter) _____
_____
_____
_____.
State all problems or failures you have experienced
_____
_____
_____
_____.

Do you feel the "Owners Manual" (2nd edition for VariEze) adequately prepared you for your (or other pilots') flights?_____If no, what should be added or deleted? _____
_____
_____
_____.
What do you like most about your airplane? _____
_____
_____
_____.
Dislikes _____
_____
_____

HOW TO DO PERFORMANCE TESTS - Easiest way to measure takeoff distance is to count runway lights. They are generally 200 ft apart - check to be sure. First, line up on the runway and center the nose gear so brake steering will not be required. Raise the nose slightly at 50 knots and lift off at the speed shown in the "Owners Manual" (depends on weight).

Measure climb rate not with a climb indicator, but by timing a 1000 ft increment with a watch. Stabilize at climb speed 1000 ft below aim altitude. Time from 500 below to 500 ft above aim altitude. Repeat several times. Do only in smooth air. Divide 1000 by time to get climb rate. Measure OAT (outside air temp) at aim altitude.

Speed determination is one of the hardest tests to fly since it requires patience and a fine touch. Be sure the air is smooth, record weight and OAT. Set the power, then hold altitude exactly for at least a full minute then note airspeed, now, increase airspeed one or two knots and confirm that after 30 seconds you are losing altitude. Then decrease airspeed to one or two knots below the target and confirm that you are slowly gaining altitude. If both happen, then the target speed is correct. Be sure to note rpm at target speed.

Room permitting we will present data reduction techniques for weight and temperature corrections and for correcting to standard day conditions in a future "CP".

PROPELLERS - Good news for those who have found an unacceptable backlog on props. We have flown another vendor's prop and found it performs very close to Ted's prop, same climb and only one or two mph slower speed. It is a 56x69 wood prop for Cont 0-200 by B & T Props, 8746 Ventura Ave, Ventura, Ca 93001 (805) 649-2721. They will also make C85 and C90 props.

We have found that many of you do not know how to balance a prop. This is necessary should you need to repair a rock nick, etc. It's also a good idea to check balance on a new prop. Slip a tightfitting tube through the center hole of your prop, long enough to stick out 1" each side. Place the prop across two level edges as shown and note which blade rotates down. Reverse the prop 180 degrees to check for

imperfect level of the edges. If you have questions on how much prop damage can be repaired, check with the prop manufacturer. When installing your prop, torque to 180 inch-pounds and check that tips track within 1/10-inch. **SKETCH OMITTED**

CANARD SURFACE SMOOTHNESS IS CRITICAL - During the Quickie program we built and installed a canard that resulted in very poor low-speed performance. Stall speed was 10 mph higher than predicted and tuft tests showed stall angle-of-attack over three degrees lower than estimated. We later traced the problem to a wavy upper surface. Since the EZ uses the same GU 25-5(11)8 airfoil, we suspected that it, too, may be susceptible to small roughness or waviness. So we tufted N4EZ's canard and put on strips of tape in various locations to simulate a wavy surface. These tests and other wind tunnel tests we conducted confirmed THE TOP SURFACE OF YOUR CANARD MUST BE SMOOTH FROM THE LEADING EDGE BACK TO AT LEAST 6-INCHES FROM THE LEADING EDGE or stall speeds may be increased and stall characteristics degraded.

Of course, the big question is "how smooth?" The best way to check this is with a steel pocket ruler, the flexible kind that's only .02" thick, or with a plastic drafting ruler. Hold the ruler as shown in the sketch, pushing it to the surface with two fingers 2 inches apart. If the surface is a smooth curve between your two fingers the ruler will lay down following the curve with no gaps. If the surface is bumpy or wavy the ruler will touch the surface only in 3 or 4 places. Take a feeler gauge to measure the gaps between the ruler and your surface. If you have a gap of more than .006-inch your surface is too wavy. Check this in several places from the leading edge back to 50% chord. The bad Quickie wing had gaps of about .012 inch. After refinishing (Featherfil, 70S, and white lacquer) with gaps of less than .004-inch, its stall angle of attack increased from 8 degrees to 12 degrees! VariEze N4EZ has gaps less than .003-inch.

The best time to use the ruler and check for smooth surface is when sanding the Featherfil with the spline. Recheck after sanding the 70S black primer. It will not change when white paint is sprayed on. **SKETCH OMITTED**

If your VariEze is now flying you can see the airflow easily and dramatically by tufting your aircraft as shown in the sketch. All tufts are 3-inch long strands of light yarn held to the airplane with a small dab of masking tape.

When the airflow is smooth the tuft will lie down steady. When stall occurs the tufts in the stalled area will shake violently or change direction. Refer to the sketch showing stall patterns indicated by tufts on N4EZ, flying at 950-lb gross weight. Above 53 knots (61 mph) all tufts are steady. Between 53 knots and 51 knots (59mph) tufts shake on the canard at the "A" area. Between 51 knots and 48 knots (55 mph) when the aircraft "bucks" the tufts shake on the canard in the "B" area, and at mid or aft cg when the aircraft exhibits "wing rock" (see "Owners Manual") the tufts shake on the aft wing in the "C" area.

So, by tufting your airplane and flying at 950 lb weight you can note the tuft patterns and airspeeds and thus compare your airplane to N4EZ. If your speeds are different it could be due to airspeed position or indicator error. If your tuft patterns are different it is likely due

to variances in airfoil smoothness. Also, if your tuft patterns are different you can expect that your stall characteristics will be different than N4EZ's. **SKETCHES OMITTED**

Gene, Burt & Tom with "windtunnel" rig to check effects of surface roughness of the GU25-5(11)8 airfoil. **PHOTO OMITTED**

VARIEZE ENGINES - Most EZs now flying are using A75, C85, C90 or 0-200 Continentals. There are three or four flying with stripped Lycoming 0-235 engines. Peter Krauss, of Stuttgart, Germany has now installed a 2600-cc, 85 HP Limbach engine (German) and reports 1600 fpm climb (1 seat), 1200 fpm climb (2 seat), and 190 mph max cruise. At 140 mph he burns 3.2 gal/hr. Our original prototype with the 1834-cc VW engine (N7EZ) has recently undergone its seventh overhaul or major engine repair, three within its last 40-hr flying. We are looking for a 60-hp Franklin to replace this engine.

VARIEZE FUEL SYSTEM - Some foreign-built VariEzes have had to change fuel lines aft of the firewall to fire-resistant material in order to obtain flight approval. USA FAR23 also requires this for a certified airplane but it does not apply to an experimental aircraft. We chose to use the low temperature Tygothane material to save cost and weight and did so because we feel the fire risk is low with a reverse-flow cooling system. Refer to the two sketches. A conventional aircraft has airflow from the engine and exhaust system blasting at the firewall. The VariEze airflow is such that the source of fire is blown up and aft, away from fuel lines and firewall.

It is possible that you, the aircraft builder, may not agree with us and may want to install your fuel system to meet FAR 23. This is your decision, of course, as you are responsible for the quality control of your airplane. If you want your system to be fire-resistant install Aeroquip 601 hose with 624 sleeve in place of the Tygothane aft of the firewall. Also, you may consider using a gascolator in place of the filter and drain. This costs more, but results in a more positive and frequent removal of sediment when you drain the gascolators on each preflight.

FAR 23 also requires steel, rather than aluminum, be used on primary controls that pass aft of the firewall. Again, since the direction of the airflow directs a fire source away rather than at these areas, we elected to save cost, weight, and building time by using aluminum. If you desire to comply with FAR 23, you may decide to make some aileron control parts from steel and accept the weight and cost penalty. We will continue to fly N4EZ with the configuration exactly as shown in the plans. **SKETCHES OMITTED**

VARIEZE NOSEGEAR FAILURES - There have been several failures of the NG1 strut where it bolts to NG15. It would be easy for us to dismiss this as a problem, since all failures we have seen can be traced to an incorrectly-placed bolt or failure to install the BID on the strut, and we have had no failure with N4EZ after 500 landings, some on rough fields. However, after closely studying this area we do admit it needs

improvement. The modification shown below should be incorporated. It should be done even if the gear has already been installed. The modification involves using a "U"-shaped steel bracket that captures the strut and eliminates the holes through the NG-1 strut. Thus, the full strength of NG-1 can be achieved, greatly reducing the chance of its failure. **SKETCHES OMITTED**

First, here's the best way to apply the BID wrap on the lower end of the strut. Refer to the sketches. Note that 1 ply BID should extend 10" up from the end and a second ply extends up 7". Be sure you have shaped the strut to perfectly fit the rounded slot in NG15, leaving room for the two plies of BID. The best way to get the BID to wrap completely around the strut without bubbles is to do it in two steps. First round all four corners then epoxy the BID only to the forward face and let cure. Then wet it out onto the other three faces overlapping the forward face. If it will not lay flat all around, wrap it with duct-tape or masking tape to hold it during cure.

Now, fabricate (or check if Brock has it in stock, yet) the steel "U" bracket, NG25. Fit the NG1 strut into NG15, and file off the bevel in NG15 to allow NG25 to slide all the way on and rest against NG1 full length. Clamp together and drill two #12 holes through NG25 and NG15 as shown. Note the holes must be drilled in the correct positions to miss NG1 and to miss the pivot hole. Disassemble, sand surfaces dull, and assemble with plenty of flox, installing the two AN3-20A bolts before cure. The nose gear door attaches to the two NG26 brackets; they bolt to the upper AN3-20A and rivet to the door with 1/8" pop rivets. **SKETCHES OMITTED**

SKETCHES FROM ARTICLE ON PREVIOUS PAGE OMITTED

WHEELS AND BRAKES - Many EZs are now flying with the modified Rosenhan brakes, all with satisfactory results. The original Rosenhan brake system is still proving to be inadequate in most cases. If you have the original Rosenhan brakes (with the triangle pad), install the retrofit kit before you taxi/fly. One builder had excessive dragging and heat buildup doing taxi tests with the original system. He had tight-fitting wheel pants installed so the excessive heat could not escape. The heat buildup was enough to soften the epoxy in the gear strut, allowing it to distort. A good solution for this is to use phenolic, not aluminum for the 1/8" spacer required at the strut (Rosenhan only) to provide insulation. Remove wheel pants for initial taxi tests when a lot of repeated braking is done.

We are recommending that you install a short length of brass or steel tubing in the ends of the Nylaflow tubing where they fit into the fittings at the brake and master cylinder. With the tube installed, the fitting makes a better clamp on the nylon line allowing higher pressures. See sketch. The tube (four req'd) is 1/8" dia, .02 wall, 1/2 inch long. It can be cut from the one-foot length pieces of telescoping tubing found at any hobby shop. Round the ends so they do not cut into the nylon tubing. **SKETCH OMITTED**

VARIEZE OR VARIVIGGEN SP PAINT COLORS - We have seen some violations of the "white only" recommendations in "Section V." One airplane has even been painted with a wide red stripe down the leading edge of the wings! This may cause serious heat distortion if this airplane is parked in strong sunlight on a hot day with no wind. The temperature of the red area will run 50 degrees F hotter than the adjacent white. Remember, all glass sailplanes are white only. Trim colors, particularly hot ones (see "Section V"), must be limited to vertical or underside surfaces, and never used across the top of wings or canard.

VARIEZE FOAM CORES - Recently, the manufacturer of the styrofoam used in the VariEze stopped making this material in the large 9-inch x 18-inch blocks. Since these blocks are no longer available, you are being supplied with blocks measuring 7-inch x 14-inch. These cannot be used as efficiently as the large blocks, thus, there is more waste and the blocks indicated below result in a total foam volume about 50-board-feet more than the previous sizes. The kit now consists of the following:

2 pieces 7" x 14" x 41"
8 pieces 7" x 14" x 64"

The information supplied below is intended to show you how to modify the procedures in the VariEze plans to obtain the correct parts from the ten smaller blocks.

CHAPTER 4 & 5, CANARD AND ELEVATORS:
Cut the canard and elevators as shown below from the two 41-inch pieces (trimmed to 40"). Save the large end of these blocks, they are needed in chapter 6 for the leading edges of the inboard wing cores. CHAPTER 6, WINGS:

Join the 64-inch pieces in four pairs as shown below and trim the 18-1/2 degree lines to the 53.25" trailing edge dimension. Square the ends, carefully measure the 9.37" dimension, and hot-wire the diagonal cuts. Add the scrap from the canard as shown to two of the pairs for sufficient foam for the large inboard cores using care to assure you don't make two left wings and that the leading edges sweep AFT, cut the four wing cores.

CHAPTER 7, WINGLETS:
Sufficient foam remains in the outboard core scraps to make winglets.

SKETCH OMITTED

CP16, Page 6

WING CORE SETUP - Trailing edge is at bottom on all four assembly drawings shown below. Templates are all placed upright. L/H are reverse of R/H. **SKETCHES OMITTED**

VARIEZE BUILDING HINTS - This simple jig will allow you to find the blind holes in the canard inserts after you have glassed the shear web and reinforcements. When installing the inserts, bolt them to a scrap piece of metal that nails to a board on each side, Bondoed to the

table. Remove the strip of metal, and glass the shear web. After cure, reinstall the metal strip and use it as a guide to drill the glass. **SKETCHES OMITTED**

When drilling fiberglass you can get a cleaner hole without the drill grabbing if you hone the lip of your drill bit as shown, flattening the draft aft of the cutting lip. On large critical holes, such as the 1/2" holes in the main gear tabs, use a spotface rather than a drill bit, for a perfect hole.

The best material for electrical conduit in the wings is a handful of soda straws. Stretch one end a bit so it will fit over the next straw. Gang them together and micro them into the slot in the wing. They are very light and large enough to push wires through for trim, or as a backup slot should you ever have to replace the rudder Nylaflow tube.

Unless you have a 10 or 12-inch drill bit you should drill the engine mount holes in the aluminum extrusions before mounting them in the fuselage.

When you lay the peel ply into the trailing edge notch before glassing the first side of wings, canard, and winglets, hold it in place as shown with a few tiny brads or staples so it doesn't move out of position when stippling the skin over it. **SKETCH OMITTED**

Up to now you have been using peel ply (Dacron surface tapes) only for preparing glass surfaces for future layups. During the Quickie program Gene discovered another use for peel ply that works so well we are using it extensively on the Model 40 and are strongly recommending that you use it on your VariEze as follows: In several places (winglet attach, fuel tank, cowling lip, nose, fuselage corner tapes) you have fiberglass plies terminating on the part, rather than on its edge. When this is done, the edge generally is rough causing a bump that must later

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be carefully sanded. Also, (see sketch) unless the edge is loaded up with excess epoxy it can lift, causing the start of a delamination. Using peel ply over these edges, by stippling down a strip of Dacron across the edge (completely wet it out), will force the edge down eliminating the frazzled bump and providing a smooth transition of epoxy with no delaminating tendency. After cure, strip the peel ply off and you will have a beautiful joint with the glass edge almost invisible and with far less sanding required. Its hard to describe how well this works. Try it yourself and see. DO use it, particularly at winglet attach. It will make your cockpit more attractive if you use it to fair all corner tape edges. **SKETCH OMITTED**

Jim Smith reports that a "zippidi-Do" low cost cutting and sanding disc (available at hardware stores) does quick work grinding glass or Bondo when used in a high-speed drill or sanding motor.

Peel-ply the foam before the first lay up on the back-seat bulkhead, where the second lay up bonds to the first. Before the second lay up you can then strip this off and save sanding work.

Aileron hinges - be sure to reverse the piano hinge before cutting the lengths. If you are a little short of material subtract 1/2" from the length of the center or outboard hinge.

The following sketch shows a builder's suggestion for a simplified boarding step to replace the kick-in one. Calculations indicate less than 1-mph cruise speed penalty. **SKETCH OMITTED**

Some builders have experienced difficulty using Featherfill ("Section V"). Be sure the surface is dry, dull, and clean. Be sure the Featherfill and shop is at least 70 degrees F. Mix the catalyst thoroughly with a paddle or wire on your electric drill motor. After mixing catalyst, mix in about 25% by volume of microballoons, and brush on. Microballoons makes it go further, fill better, and sand easier.

Do not make the armrests removable. If you want better access around the stick, make a small removable panel locally where access is required.

Nat Puffer made up a bracket like the sketch below that mounts to the Brock throttle arm and provides attachment for a pushrod to a back seat throttle. This requires a hole in the inst. panel to clear it at idle, and simplifies installation of the gear-warning micro switch. **SKETCH OMITTED**

INSPECTION - We are still seeing some parts that have to be rejected because of flaws that could have easily been fixed before cure. Copy the following inspection summary. Post it in your shop. Read it before leaving any part to cure.

LAY UP INSPECTION CHECKLIST

1. Correct number of plies
   Correct type of plies
   Ply orientation within 15 degrees
   Ply wrinkles - free of major disruption
2. Surface condition - Smooth, free of joggles or bumps (measure with 12" straightedge span-wise)
3. Foam surface voids
   Uniform slurry, no visible air, no debonds
4. Air bubbles and white air flecks - none present
5. Lap joints - stipple and check for delaminations. TE and LE must be perfect.
6. Inclusions - FOD, brush bristles
7. Resin rich - Test with squeegee. Runs and pools removed.
8. Peel ply glass edge terminations or areas for later bond.

EPOXY MIX RATIO - Those who have purchased the ratio pump may have noticed that it is labeled "4 to 1" (25 parts to 100). This is by volume. Thus, due to different resin and hardener densities the pump actually ratios 22.5 parts to 100 by weight. The plans scale ratios 20 parts to 100 by weight. Our epoxy formulator advises that the acceptable range is 18 to 24 parts by weight and that it's best to be

on the hardener-rich side. So, we are changing the scale dimension for the hardener cup from 15 inches to 13.6 inches to obtain 22 parts to 100.

VARIEZE FUSELAGE TANK - Further clarification is required, since there are several ways to build this, some easier than others. The following method is easy, light, and makes use of your left-over 9mm, red PVC foam. Install the tank when you get to chapter 22, step 3. Do not install the urethane foam behind the plexiglass where the tank will go.

Cut the front and back bulkheads to fit the firewall and canopy, making the bottom in a "V"-shape as shown to allow the main tank vents to go under the fuselage tank. Cut the bottom pieces to fit and nail them in place. Now using a hair dryer, heat-form the curved top/side piece to fit the bulkheads and match the firewall and canopy. Remove the tank. Remove the front bulkhead. Bond the sides, bottom and rear bulkhead together with wet micro and lay up one ply BID inside. Install vent, outlet and screen. Glass the inside of the front bulkhead with 1 ply BID and micro it on the tank (use a strip of plastic tape on the foam where it will be removed for the sight gauge, to eliminate having to sand the surface later). When cured, round the corners and glass the entire outside surface of the tank with 1 ply BID. When cured, leak check using an altimeter and 1500-ft pressure differential. Drill a hole in the firewall to let the outlet through, then micro the tank in place, laying one ply over its outside, lapping onto the firewall and fuselage.

Install fuel cap. **SKETCHES OMITTED**

WINGLET ALIGNMENT - Some have had difficulty using the template and plumb bob to align the winglet to the wing. The following method is more accurate if measurements are taken carefully. It involves three measurements from a point at the wing root fitting to the winglet leading edge, trailing edge, and tip. Before trimming the piece from the winglet in step 1, set the root template on the root and transfer the chord line (waterline) up the leading edge as shown. When positioning the winglet on the wing in step 2 use dimensions A, B, and C instead of the positioning template and plumb bob. First measure dimension A from your mark on the winglet leading edge to the .063 aluminum plate (WA-6) on the aft side of your wing fitting. Make a mark on WA-6 where dimension A ends up. This mark is now used to measure dimension B to the bottom trailing edge of the rudder (held neutral) and to measure dimension C to the top trailing edge of the winglet. This accurately sets winglet incidence and outward 'cant.'

A = 108.3 inches

B = 117.0 inches

C = 126.0 inches

SKETCHES OMITTED

VARIEZE EXHAUST FAILURES - Bad news - The exhaust systems on VariEzes continue to be a problem. Recently, even the short system has failed, both with stainless and mild steel material. Data available to us on the entire history of EZ exhaust systems is shown below.

System	Number of Airplanes	History of Durability
1	1(N4EZ)	Cracked at "A" in 20 hr, glass pack degraded at 15 hr.
2	1(N4EZ)	Cracked at "A" & "B" in 50 hr
3	approx 15	Original in N4EZ failed at "A" in 80 hr. Many homebuilders had cracks in less than 50 hr. One stainless system cracked in 12 hr.
4	approx 10	No failures in N4EZ at 100 hr when removed for muffler installation. Homebuilders have had cracks and complete failures at flange in 80hr, 20 hr & 6 hr. One is operating at 130 hr without failure.
5	approx 15	No known failures, however, system may be too short for adequate heat protection of engine valves.
6	1(N4EZ)	High-quality Flight Research Inc muffler-system being developed for Cessna for 150 retrofit. No signs of failure at about 90 hr. Extensive history of durability on Cessna 150.

The most important thing we can tell you about the exhaust system is in the next five sentences. Read and follow them carefully. If a piece of failed exhaust system should drop from the cowl and strike the prop it can fail the prop, cause excessive vibration, and possibly destroy the aircraft. If you are using system #4 or 5 you should immediately (before next flight) install a safety attachment to each tube to retain it in the event it fails at the flange. This can be a small welded tab with several loops of .041 stainless safety wire strung to a bolt or tube on the engine, or a small hole with a loop of 1/6" stainless cable looped over an engine component. This is a definite safety of flight item. Do no risk loss of your aircraft or life due to exhaust tube failure.

We are presently working with Brock to develop a system that we feel has a good chance of solving this problem. It is similar to systems that have good durability in other applications. We will be flying it soon and will keep you posted on the results (see system 7).
SKETCHES OMITTED

Now for the good news. The muffler system built by Flight Research Inc (reported on in "CP" 13, 14, and 15) has recently undergone some internal modifications to reduce its noise level over that listed in "CP" 15. It is now 6 db quieter than their previous muffler (a

reduction of 6 db is a 50% reduction of noise level). Flight Research Inc manufactures the muffler system for the Cessna 152, which had to meet the rigorous, new noise requirement. They are now producing a quiet system for Cessna for replacement on the 0-200-powered Cessna 150's. This is the same system now on N4EZ. It is available now from Flight Research Inc, Airport Hangar 61, Mojave, Calif 93501. This system is complete with muff for carb heat and cabin heat. It is a bolt-on installation on the 0-200, but requires a modification to the cowl, adding "blisters" (see "CP" 14). We built our own blisters by glassing 4 ply BID over a foam bump. We are planning to get tooling prepared so the blisters will be available from Jiran. Thus, the homebuilder cuts holes in his cowl and installs the blisters. All indications are that the Flight Research mufflers will not be susceptible to failures and certainly cannot get to the prop should they do fail. **SKETCHES OMITTED**

VARIEZE PLANS CHANGES

Section I pg 11-7	Foot depressions in back seat should be 1.0, not 1.7 deep to allow room for landing brake, if used.
Section V	Hencolac NUL-V paint is no longer manufactured. Use acrylic lacquer, enamel, or acrylic enamel.
Newsletter 14 pg 8	Dimension missing on exhaust drawing. If radius is too large, pipe will interfere with intake manifold. **SKETCH OMITTED**
Newsletter 13 pg 11	Bill of materials under instrument plumbing -015 should be 0715-015. An315-3(4) should be AN315-3(14)
Section IIA & Section IIC	Ryan Herco fittings in white nylon are different part numbers than the previous polyethylene. Polyethylene Nylon 0715-020 0716-020 Tee 0710-162 0711-162 Elbow 0700-162 0701-162 Adapter
Section IIC page 5	F.S.132.77 should be F.S.133.28
Section I & all "CP"	Wicks Aircraft Supply address should be 410 Pine St, Highland, Il. 62249 (618) 654-7447
Section V	Add "check surface contour as described in "CP" 16.
Section I pg 17-9	Add "do not drill in NG15 - See "CP" 16."
Section I pg 18-3	Add "see "CP" 16 for added tube in Nylaflow fittings on brakes and master cylinders."
Section I pg 3-2	Change 15 in to 13.6 in, change 20-part to 22-part

Section IIa & IIC — Note exhaust system changes in "CP" 16.

SHOPPING - Continental A-75's OSMOH $1900. Kal Nelson Aviation Inc, 9801 Glenoaks Blvd, Sun Valley, Ca 91352 (213) 875-0388.

Aircraft Spruce now has VariEze metal placards with special adhesive for bonding to your fiberglass panel. These are die cut and ready to install. A print of the placards is shown below (not full size). FAA requires full placarding to license your aircraft. **PRINT OMITTED**

Shelf-life of epoxy is two years. Distributors cannot replace epoxy due to settling, etc., if it is approaching shelf-life time.

MIKE & SALLY MELVILL'S VARIVIGGEN

Check the March issue of EAA "Sport Aviation" magazine for an excellent article on November-Two-Seven-Mike-Sally, the Melvill's spectacular VariViggen. This article covers all of Mike's experiences building and flying his Viggen up to December 77, including some great color photos. Note the article has an error - 100 ft/min should be 1000 ft/min. Mike's Viggen is the craftsman's dream in every way, down to the beautiful modern-fighter cockpit layout and upholstery. Since the article was written, Mike and Sally flew to the Sun-N-Fun flyin in Florida and won the runner-up Grand Championship trophy. Their trip totaled over 30 hours including a visit to Key West and flying demos and Mike reported no maintenance was required. Sally is now checked out in the front seat and flew N27MS on their last trip to Columbus.

The adjacent photos show the screen assembly Mike fabricated to protect the prop from any damage due to items loose within the engine compartment.

Mike has prepared the "part two" of the VariViggen construction Manual and is marketing it, himself. This manual has some very valuable information on jigging, skinning, building and trouble shooting the gear retraction system, canopy, firewall, cowling, baffling, exhaust system, SP wing, etc. The manual is $16.00, and is available from Mike and Sally Melvill, Bx 561, Frankton, In 46044, (317) 649-2576. Mike is happy to answer questions you may have about his Viggen or about the construction manual but don't forget to send a self-addressed, stamped envelope for his reply.

Mike redesigned the main gear retraction system to a more complex, but much more durable mechanism. His has been well tested, including over 175 landings on N27MS and has performed flawlessly. He now has available professionally-drawn drawings of his gear retraction system. They are $10.00, from Mike and Sally at the above address. This is a better system than is shown in the VariViggen plans.

JESSE WRIGHT VARIVIGGEN KITS - Jesse now has available a very accurate set of ribs for the vertical fins as well as detailed installation instructions. Viggen builders should contact him for details on canard parts, fuselage bulkheads, inboard ribs, also. His parts are priced

reasonably and can save a great deal of building time. Send 50 cents when asking for info, to pay his printing and mailing cost. J Wright, 7221 S. Colorado Ct., Littleton, Co 80122.

VARIVIGGEN SURVEY - We have no idea how many active builders there are at the present time. We are asking all VariViggen builders to send the following info to RAF. Results of survey will appear in a future "CP".

Name_____S/N_____
Date started construction_____
Currently active building? yes, no.
Chapters of Plans completed_____.
Estimated completion date_____.
Which wing: SP, Standard. Engine type_____.
HP_____.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Mike's screen. Welded frame with stainless net and camloc tabs.

Sally is 2nd gal to fly a Viggen. Carolyn Rutan flew N27VV first in 1973.

Mike & Sally's Viggen.

Harold Reiss' Viggen.

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft stick	49 mph
	Landing	500 ft
Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 square ft
	Wing Span/Area	19 ft/119 square ft
	Empty Weight	950 lb
	Gross Weight	1700 lb
Performance with 150-hp. Special Performance Wings Specifications	Climb	1000 fpm
	Cruise	158 mph
	Wing Span/Area	23.7 ft/125 square ft
Special Performance Wing	Gross Weight	1700 lb

PROVEN DESIGN

Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS:

AIRCRAFT SPRUCE & SPECIALTY CO, 201 W. Truslow, Box 424, Fullerton, Ca. 92632 (714) 870-7551.
VariViggen spruce kit, plywood kit, hardware, aluminum and fiberglass. Catalog cost $2.

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680 (714) 898-4366.
VariViggen prefabricated components: all machined parts. Catalog costs $2.

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave, Dayton, Oh 45424.
VariViggen plexiglass canopy.

MONNETT EXPERIMENTAL AIRCRAFT, INC, 955 Grace St, Elgin, Il 60120 (312) 741-2223.
VariViggen molded fiberglass parts.

GOUGEON BROTHERS, 706 Martin, Bay City, Mi 48706.
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS, 4102 Twining, Riverside, Ca 92509.
VariViggen welded nose and main landing gear, 1-1/4" sq. steel tube.

MIKE AND SALLY MELVILL

Part Two of Construction Manual
Box 561, Frankton, Ind. 46044

JESSE WRIGHT (VariViggen builder), 7221 S. Colorado Ct, Littleton, CO 80122 (303) 771-5140.
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price: $4.75 per year first class mail, $6.50 air mail overseas. Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing, 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described. Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles. Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications

required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price: $4.75 first class mail, $5.50 air mail overseas.

VARIVIGGEN CONSTRUCTION MANUAL Part 1 of a photo-illustrated construction manual, written by Jim Cavis, S/N 31. Includes fuselage, canard, inboard wing, vertical stabs, control system, and landing gear, along with approximately 100 photos. Part 1 also includes helpful sketches on jigs and numerous building tips. The written information is similar to plans chapter 5, except expanded to about 30 pages. Price: $18.50 first class mail, $20.50 airmail overseas.

CP16, Page 12

VARIEZE

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $2600 (less engine) in about 1000 man-hours, or from prefab parts and materials, costing approximately $4000 in about 600 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair. The VariEze uses the small four-cylinder Continental aircraft engines. The 0-235 Lycoming, stripped of starter and alternator, is now being tested and should be available soon. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 20 gallons of fuel. Frontseat passengers up to 6', 7"/250 lbs and backseat passengers up to 6',5"/220 lbs can be accommodated plus a modest amount of baggage in two custom suitcases. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (60 kt/70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or

combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance. THE TEST PROGRAM The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE HOMEBUILDER SUPPORT The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$94.00	$108.00
Section IIA	$19.00	$21.00
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95
Add 6% tax if Calif resident - newsletter is not taxable.		
*US. FUNDS ONLY		
TOTAL		

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and

induction systems, carb heat box and muff, cowling installation, prop and spinner.

SECTION IIA - Continental A65, A75, C85, C90, 0-200

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS & PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP AT GROSS WEIGHT:

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	560 lb
Gross Weight	1050 lb
Range at Max Cruise	700 mi
Range at Econ Cruise	850 mi
Min Speed (full aft stick)	55 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6 square feet
Canard Span/Area	12.5'/13 square feet

SPECS & PERFORMANCE WITH 75-HP CONTINENTAL:

Take Off	1050 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	530 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGUES AND DESCRIPTION OF ITEMS.

AIRCRAFT SPRUCE & SPECIALTY CO.
201 W. Truslow Ave, Bx 424,
Fullerton, Ca. 92632
(714) 870-7551 All Raw Materials
Catalog costs $2.

OR

WICKS AIRCRAFT SUPPLY
1100 5th St.
Highland, Il. 62249
(618) 654-2191

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680
(714) 898-4366.
Prefabricated components: wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, Bldg 6, Mojave Airport, Mojave, Ca 93501
(805) 824-4558.
Prefabricated components: cowling, fuel tanks, wheel pants, maingear and nosegear struts, strut cover and nosegear box.
Send SASE with 3-oz postage for brochure.

COWLEY ENTERPRISES, Bx 14, Santa Paula, Ca 93060, (805) 525-5829.
Plexiglass canopy.
H.C. COMMUNICATIONS, Bx 2047, Canoga Park, Ca 91306, (213) 882-0422.
Custom COM & NAV VHF antennaes.

THE CANARD PUSHER NO. 17 July 78

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If you are building a VariViggen you must have newsletter 1 through 17. If you are building a VariEze from the first edition plans you must have newsletters 10 through 17. If you are building a VariEze from the second edition plans you must have newsletters 16 and 17. Reproduction and redistribution of this newsletter is approved and encouraged.

RAF ACTIVITY since the April newsletter has been hectic. Builder support demands have been high with many new construction projects started and over 20 first flights since April. The excellent safety record has been marred by two fatal accidents which are discussed later in this newsletter. Also, during this time period the plans for the Quickie were completed and shipment of the first Quickie kits has begun. Our new light twin, the "Defiant" made its first flight on June 30.

We have completed additional contract work on the NASA skew wing AD-1 and have run further tests on our solar water heater. So, please excuse the patched-together appearance of this newsletter as it is being crammed together on an extremely tight schedule to get it out before our Oshkosh trip.

Since many of you do not know the size of RAF we are including the adjacent photo. Paul Striplin, on the left, helped us build the Defiant and has now left to pursue his own ultra-light project. Next is Dick Rutan, Burt's brother, who has worked full time at RAF since retiring from the Air Force in April. Dick has extensive flying experience both in general aviation and military fighters. He also holds an A&P license. He now owns the VariEze prototype, N7EZ, and is in the process of removing its Volkswagen engine and installing a Franklin 60-hp which he plans to use to make some record flights. Next are Burt and Carolyn Rutan, founders and owners of RAF. On the far right is Marge Merrill, with us since April. **PHOTO OMITTED**

DID YOU KNOW? Ferde Grofe's film "Flying is VariEze," has won the Aviation Space Writers Association's Award for Visual Communication. See "CP" 13 if you want a copy of this film.

The VariEze plans (Section 1) are now available in the second edition, with all revisions from the first two years incorporated. The Section I education chapter is extensively modified, incorporating all the new methods now recommended. Due to the large amount of builder support

and inflation we have raised the price of Section I. Prices for all other items are the same (see attached flyer). This is our first price increase since we started business in 1973. We plan to have Section IIA and the VariViggen plans updated to a second edition soon.

The AD-1, designed at RAF and being built by Ames Industrial Corp, N.Y., is 70% finished and should be delivered to NASA late this year. The adjacent photo shows the aircraft. It is about the same diameter as an EZ, but is over 35 ft long. Its entire structure is basically similar to a VariEze.

The VariEze is approved for construction in Australia, but is being held up in Canada due to a wing-loading restriction.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Mike & Sally's Viggen with N4EZ.

AD-1 skew wing aircraft.

The adjacent photo shows the largest gathering of VariEzes in the world. At a surprise birthday party (35th) for Burt given by Carolyn, all nine showed up at Mojave in June. Attending the EZ's were Don Shupe, John and Wilma Melville, Ed and Jo Hamlin, Jim Heitkotter, Les Faus, Hal Reynolds, Ernie Taylor, and Dick Rutan. The party was attended by over 80 people!

CP17, Page 1

The VariEze/VariViggen survey results ("CP" 16) have not yet been completed since only about 10% of those flying have supplied the data. Those of you that are flying, please send in what info you have even if it is incomplete, so we can get it complied and printed in the next "CP".

Based on information received at RAF there are about 65 VariEzes that have flown. About 90% of them are currently in active flying status. Several have been damaged in minor accidents, have been repaired and are back flying. Two have been damaged beyond repair.

We have just completed a photo session with noted "National Geographic" photographer, James A. Sugar. The photos are intended for an article to be published next year on the subject "Advances in Aviation." Mr. Sugar, who is well known for his special effects set up some spectacular shots including one with a wide-angle remote camera mounted on the nose of the Defiant looking aft. This shot was done at dusk, with colored strobe lights illuminating the inside of the cockpit and included the VariEze in close formation behind. "National Geographic" always does first-class photography, so we are certainly looking forward to seeing the article.

QUICKIE - The Quickie program is off and running! The initial kit deliveries began in early July. Current backlog on kits is approximately 2 to 3 weeks. The prototype, N77Q now has over 125 hours flying time. Tom and Gene plan to fly it to Oshkosh on the 25th or

26th of July, so if you live along Route 66, look up! The Quickie has received some excellent coverage in the aviation press, including "Flying" (color coverage in June issue), "Air Progress", "Plane and Pilot" and various others. Peter Garrison, well known to "tell it like it is", had this to say in the "Flying" article after his flights in N77Q. "The beauty of the stalling characteristics (which are shared by the VariEze) is that you get perfectly clear, perceptible stall warning without any loss of control or much loss of performance. At sea level with the stick full back and with full throttle, the Quickie will actually climb, bucking, at 150 fpm.* A high effective aspect ratio further assures that there will be little loss of climb performance in turns; so in the Quickie, you can maneuver with perfect confidence at minimum speed, all the while climbing, treating the stall regime just as you would any other portion of the flight envelope."

"The upswing in my confidence is remarkable. Suddenly I can't resist the temptation to keel over past 90 degrees and dive toward the little figures beside the runway. With the throttle back at idle, the airplane suddenly feels silken. It's delightful to fly. On the deck at almost 110 knots, I sail past the spectators, then pull sharply, watching the airspeed; it bleeds off slowly. Near the end of the zoom, I drop a wing, turn 90 degrees and level out in gentle bucking, then pick up a few miles an hour, keel over again and swoop down for another pass. The knowledge that this airplane can't run out of airspeed does wonders for my enjoyment, and I realize that unconsciously I am adjusting my climbs and descents to conserve potential energy, in the same way that glider pilots unconsciously adjust speed and course to capitalize on small upward air movements. Despite the scanty surplus of power, I am able to work up and down a block of air nearly 1,000 feet deep without devoting much time to scrambling for height. The combination of its fine, effortless, intuitive handling qualities, clean design and perfect immunity to low-speed mishandling makes it fantastically enjoyable to fly. It's a toy, but one of those high-grade toys that work sublimely well. Its long suit is gadding about on weekends, airport-hopping, dog-fighting or racing over the wilderness, belly to the ground, leaving no mark behind. It's cheap, it's easy, it's safe, and, best of all, it's a good airplane, a pilot's airplane and really a joy to fly." Peter Lert's "Air Progress" article had quite bit to say about stall characteristics: "Like the VariEze and Burt's earlier Vari-Viggen, the Quickie can't be stalled; the wing loading and airfoil of the canard are chosen such that it invariably stalls before the aft wing, and hence cannot pull it up to a stalling angle of attack. Thus, the "stall" consists of the canard stalling, then dropping until a knot or so of speed is gained, then stalling again, and so forth; to the pilot, this appears as a pitch oscillation of perhaps 15 degrees at the most. In the VariEze, I'd call it "nodding"; since the Quickie is so short-coupled, the motion is a bit faster, and I'd call it "bucking." After the first couple of cycles, during which it increases in intensity, it remains steady; about like running an outboard skiff over 6-inch chop at about 10 mph. This is with the stick held fully aft against the stop, mind you, and at full power in this condition the Quickie won't nose up to the vertical and roll over--it can't. It just sits there and bucks, climbing at maybe 160*fpm. Roll it into a turn (since the aft wing never stalls, the ailerons are still effective) and it just bucks its way around the turn. I was, and am, impressed--this may just be the safest plane I've ever flown, at least as far as low-speed flying qualities are

concerned." The Quickie is probably the easiest single place aircraft for a low time pilot to transition to. Its pilot demands are small and its flying qualities are honest in every way. One pilot with flying experience ranging to military jet fighters commented that the Quickie was the most fun airplane he had ever flown. For further info on the Quickie, or for their excellent $6.00 info package contact Tom or Gene at Quickie Hangar 68 Airport, Mojave, California 93501 (805) 824-4313.

*Later data show this to be 300+fpm at sea level.

CAN I BUILD A COMPOSITE AIRPLANE? WILL I ENJOY WORKING WITH GLASS & FOAM? IS MY WORKMANSHIP ADEQUATE TO BUILD AN AIRPLANE? WHAT ARE THE TECHNIQUES USED IN VARIEZE & QUICKIE CONSTRUCTION?

There is now available an introductory kit to answer these questions for you. The kit consists of a book and sample materials, or the book can be purchased separately. The book, "Moldless Composite Sandwich Homebuilt Aircraft Construction" consists of 26, 11x17 pages (equal to 52 pages) describing how the material is applied, education on the materials, tools required, inspection and repair methods. The bulk of the book is the new second edition education chapter from section I. Sample materials include: foam, fiberglass (2 types), epoxy, microspheres, flox, peel ply, wire for hotwire saw, etc. The book is $14.50, and is available from Aircraft Spruce, Wicks Aircraft Supply, and Rutan Aircraft. (Add state tax, if resident). The kit (book and materials) is $45.50, and is available from Aircraft Spruce and Wicks, not from Rutan Aircraft. (Add state tax, if resident).

DEFIANT PHOTOS OMITTED

DEFIANT - Our new light twin made its first flight on June 30, 1978, with Burt at the controls. Within one week Burt and Dick had logged enough flying for FAA to remove its area restriction and had obtained all basic performance verifications. The only maintenance or adjustments required has been changing the stiffness of the nosegear steering pushrod. This has been the cleanest initial test program we have seen on any type aircraft.

Curtis Barry, Port Jervis, N.J. won the "Name-the-Plane" contest. He added that defiant infers, "the aircraft defies all the common assumptions about current production twin engine aircraft - in pilot skill required, safety, performance, construction, and handling." We waited until after the aircraft had flown to name it, as we wanted to be sure it did indeed meet the above definition. As those of you that have recently visited know, we are extremely excited around here, since we are finding that Defiant actually is exceeding the estimated performance estimates and is verifying the no-procedure-for-engine failure design goal. It doesn't take a lot of study to realize the impact on flight safety of a twin that not only has no appreciable trim change at engine failure, but requires no pilot action when it does fail. You can fail an engine at rotation for takeoff or during a go-around in the landing flare. The pilot does nothing, he climbs out as if nothing happened. He has no prop controls to identify and feather.

He has no cowl flaps to open, no wing flaps to raise, no min control speed to monitor (he can climb better than the other light twins even if he slows to the stall speed), no retrimming is required, he can even leave the gear down with only a 50 fpm climb penalty. The only single engine procedures are the long term ones: (1) cross feed if you want to use all fuel on operative engine, (2) magnetos off. Note that, in general, you do not lose the alternator or vacuum pump on the failed engine since the engine windmills at 1000 rpm (fixed pitch prop). Why no cowl flaps? The two updraft cooling systems were designed to have large positive cooling pressure increases with power and angle of attack. When you are cruising the cylinder head temps stabilize at 370 degrees F. If you then fail an engine and execute a full power climb and slow to best single-engine climb speed the full-power engine will cool to 350 degrees F with no pilot action (same mixture). The engine installations are simpler than the most simple single. Baffling is less complex, blast tubes for mags or ram air plumbing for carb and carb heat are not required. There are no oil coolers. Oil temps run to 200 degrees F during a climb to 15,000 ft and stabilize at 190 degrees F at high cruise at outside air temperatures of 40 deg above standard conditions!

The most surprising good news is that the Defiant does not have the annoying, loud out-of-sync noise common to the Skymaster. The pilot has to split the throttles considerably to detect out of sync at high power, and at low or medium power the sync noise is not detectable. The sync noise is more objectionable on other twins than Defiant, even though they use constant speed props mounted on wings. We feel the main reason is the high damping of the Kevlar/wood props and composite structure. Using Flight Research mufflers, the Defiant makes less perceived noise for a ground observer than the average medium performance single.

The airplane is a stable IFR platform, with less trim changes than conventional twins. It has a very solid "big airplane" feel. Approach speed is 75 kt at light weight and 85 kt at gross. We are withholding detailed performance data until it is completely generalized and presented for all weights, but the following is typical of that being obtained: Cruise at 65% power (maximum cruise) at 12,000 ft is 188 kt (216 mph) without wheel pants. Single engine climb gradient (ft increase per mile) is almost twice that of the new light-light twins at any given loading condition. Single engine service ceiling is well above these aircraft even with the gear down and the airspeed 15 knots off the best climb speed, and this is obtained instantly, not after a clean up procedure! We gave Joe Tymczyszyn, FAA test pilot from the Los Angeles AEDO a ride that included single engine go-arounds initiated in the landing flare. His comments "unbelievable, single engine procedures are refreshingly simple."

The Defiant is big inside - 2 inches wider elbow room, 8 inches longer cabin, 6 inches more knee room in back seat and 3 cubic ft more baggage volume than the Beech Dutchess. To get to gross weight in Defiant you can top the tanks for 1100 NM range, add four 175-lb adults and add 75-lb baggage to an IFR-equipped airplane.

We will continue to keep you informed about the Defiant through this newsletter and other magazines. Please do not ask about further information at this time. We have no plans to market Defiant at this

time. It is merely a proof-of-concept prototype for aerodynamic research.

CP17, Page 3

VARIEZE'S FLIGHT RESEARCH MUFFLER SYSTEM - We have received the first VariEze owners' comments on the new muffler system ("CP" 16) - Lee Herron's comments follow: "Mufflers arrived Thursday evening, built the blisters on cowl Friday evening and Saturday and flew to two fly-ins on Sunday. Technically they look great and blowing the exhaust inboard at the fuselage boundary layer then through the low speed area of the prop is brilliant! As for noise, it is much quieter but now the cabin air intake (vent) makes too much noise - any ideas? As for speed about 4-5 mph penalty. Heat buildup around mufflers was a problem on the 1st test flight, but we cut outlets in the rear of each blister (see photo) and it cured the problem - cylinder head temp was not affected by mufflers. The small bump on the left blister is to clear the carb heat hose - carb heat is 15 degrees better now." Note that Lee carefully sealed around the exhaust pipe outlet. On N4EZ we left about 0.3" gap around the pipe to allow excess heat to escape and we don't need the outlets.

Additional comments on the F.R. mufflers: Do not omit the support on the front of the right muffler. This is a piece of 3/8x.035 steel tube flattened on each end. It bolts to the tab on the muffler and to an accessory case stud on the engine as shown. If you want to use cabin heat you can plumb it as shown. **SKETCHES AND PHOTO OMITTED**

VARIEZE FUEL SYSTEM - We have had reports from several builders indicating that the fuel valve has become stiff and hard to turn in service. One builder solved this by lapping the valve with valve-grinding compound and substituting a lighter spring for the one in the valve. If your valve is hard to turn (over 5-lb force at handle) fix it before you fly. One builder had to make a forced landing because the valve was so stiff that it was not completely in the "wings" position when selected. If it is only 20 degrees toward the "fuselage" position it will drain the fuselage fuel into the wings! Thus, when he selected fuselage for the descent after nearly depleting the wings, he ran out of gas since the fuselage tank was empty. Also, note that the rivet that attaches the valve to the universal should be changed to a #8 screw so the valve can be easily removed.

One EZ owner stuffed baggage into the compartment behind the seat in such a way to pinch off the fuel lines and restrict fuel flow - be careful about this.

COMPOSITE CONSTRUCTION
A problem area has been discovered recently that is very important and should receive the utmost attention of everyone building foam and glass. Nat Puffer noticed a debond bubble on his wing after the aircraft had been painted. A similar debond was noticed on the Quickie vertical tail (a debond is where the glass lay up detaches from the foam, a delamination is where individual layers of glass cloth detaches from each other). Nat and RAF traced the problem to the following: the debond occurred in areas where the glass lay up was slightly dry, ie.

where pin holes from the surface can reach down to the blue foam. Nat wiped his wing down with solvent before applying the primer. The solvent and traces of the primer reached the foam surface and locally dissolved it. Note that this occurs only with the blue foam, not PVC or urethane. These debonds were easily repaired by drilling holes at opposite ends of the debond area and injecting epoxy in one hole until it came out the other, then weighting down the bubble during cure.

Because of this possibility we are insisting that you: (1) Never wipe down wings, canard, vertical fins, or control surfaces with any type solvent. (2) Before applying materials that can attack blue foam (featherfill, primer, etc.) inspect carefully for dry areas and fill them by wiping on epoxy (RAEF), then sanding dull after cure. (3) Inspect your critical structural areas ("CP" 15, pg 5) for debond by tapping the surface with a 25 cents coin - a debond will be indicated by a "dull thud" rather than a sharp "knock" when the coin is lightly struck on the surface. This can (and must) be done on both a finished or in-construction aircraft.

Shelf Life - Epoxy which has exceeded its two year shelf life should not be used in any critical aircraft parts regardless of its apparent acceptability. This is always the case in aircraft manufacturing and of course should be followed by the homebuilder.

Workmanship - Always question yours and others' quality of construction. Remember, the quality control criteria represents absolutely minimum acceptable quality - yours should be much better on the average. Never accept voids where complete surfaces should contact. Be sure to get complete squeeze out of bonding materials. If you see someone doing marginal or unacceptable work, suggest that he review all the QC requirements, chapter 3 material and all hints in newsletters. Then he should build a noncritical part and inspect it. If it does not look good he should consider not completing his airplane. The only thing worse than no airplane is an unsound airplane.

Peel Strength - We have received several comments on how easy it is to delaminate fiberglass plies after they begin to peel. Large difference between tensile and peel strength is one of the primary factors that determine the ply configuration during design. The following values are averages and you can test for them if you wish to check your workmanship. A 1-inch wide strip of UND has a tensile strength of about 660 lb. If it is peeled up from a surface it will peel off with a 20-lb pull at 45 degrees from the surface and only 7 lb if the strip is pulled at 90 degrees (straight up from the surface).

VariEze Main Gear Torsion Stability - Les Faus had a strange thing happen to his main gear. While his airplane was sitting in the hangar on a hot day his gear twisted to an exaggerated toe-in angle on one side. This should not have occurred, as it is believed the temperature did not exceed 130 deg F. His gear was removed and placed in Jiran's oven where it promptly returned to its correct shape. We suspected the

primary cause to be that Les had not installed the 45-deg BID wrap on the strut ("CP" 13 and 15). The BID wrap stabilizes the strut in torsion if the epoxy should soften at high temperature. To verify this we built the rig shown in the photo. It is a VariEze gear with an unwrapped strut on one side and a wrap (per "CP" 15 using RAEF) on the other side. It is loaded to simulate the torsion of a parked airplane, full of gas. The struts are painted black so their temperature stabilizes at 140+ deg in our desert sun.

While we were unable to obtain the exaggerated twist of the Faus gear we did verify that the BID wrap must be used. After one week of exposure the wrapped gear had a sag of 0.3 inch. The unwrapped side sagged as much as one inch then returned (still loaded) to about 0.8 inch. Be sure you have correctly installed your wrap. If you have fibers at 90 degrees instead of 45 degrees, for example, there is no torsional support. If you have noticed excessive tire wear, check your toe-in - it can have long term creep if the BID wrap is not installed properly. This has not occurred on N4EZ even though it is continuously parked either outside or in a non-cooled hangar with outside temperatures as high as 115 degrees F (46 degrees C). N4EZ has never required toe-in adjustment. It averages 80 to 100 landings on a set of the 4-ply tires. If your gear appears to have BID on it as received from Jiran this is only a cosmetic repair of mold surface voids, not the required homebuilder-installed wrap. **PHOTO OMITTED**

BUILDING HINTS
A carpenter's square is handy for checking gear toe-in; hold one leg on the axle and sight down the other leg to a target in front of the airplane. Be sure CS12 arms are lined up to sight into the pivot holes of all CS2's. CS12 may have to be rotated to line up all pivot holes (pg 5-4 of Section I).

We have noted some inaccuracies in the Westline tachs (RPM indicators). The best way we have found to check them is to build a low-cost Heath kit "Thumb Tach" model GD#69. This little hand-held box will indicate RPM by pointing it at a propeller, measuring the frequency of sunlight reflected from the blades. It even works well from the back seat of an EZ in flight. It is accurately calibrated by pointing it at a light bulb (60 cycles/sec).

When finishing glass in preparation for featherfill, use coarse 36-grit paper, since featherfill requires a mechanical bond, not a chemical bond. Do use the 25% micro in the featherfill. We finished the Defiant twin with featherfill, 70S primer lacquer putty for pin holes then painted with Dupont Centari white acrylic enamel. We had excellent results. The Defiant has 2-3 times the surface area of an EZ. We used 4 gal featherfill, 5 gal of 70S, and 1-1/2 gal of Centari. Total finishing weight growth was 18 lb.

It is acceptable to use soapy water if required to check for fuel tank leaks (repair per "CP" 14, pg 10). If you do, be sure to rinse the area well with clean water and allow it to thoroughly dry before applying epoxy or primer.

Be sure to check the thickness variation of your brake discs before you taxi, particularly if you have an early Rosenhan set. Uneven discs or unbalanced wheels can cause main gear vibration.

EPOXY SENSITIVITY - The U.S. Department of Health, Education and Welfare has a booklet on practices for fiberglass lay up - HEW publication (N10SH) 76 - 158; contact HEW, 4676 Columbia Parkway, Cincinnati, Oh 45226

VARIEZE PITCH CONTROL SENSITIVITY - The VariEze pitch control system was intentionally designed for lighter control forces than a conventional aircraft. The reason for this is that a side arm control is used, whereby the pilot rests his arm on the side console and uses only his wrist muscles to fly the stick. The lower control forces (higher sensitivity) have nothing to do with the aircraft being a canard configuration. We have found that in a large percent of cases (at least half) that this has not been desirable for transition of pilots who have never flown a sidestick. Most pilots on their first flight in the VariEze make the takeoff with a hard grasp of the stick and use their biceps to fly, much like they would in a Cub or Cessna. In this configuration the airplane feels overly sensitive and is difficult to fly smoothly. While we know of no accidents caused by this it is not unusual to see a VariEze bob up and down during its first few seconds of flight with a new pilot. Using some hindsight, which is always more accurate than foresight, we have concluded that in general it would be better to have much stiffer controls in VariEzes, with more stick force required to change attitude (less sensitive). Within the last two months we have tested a wide chord elevator on N4EZ and on two other VariEzes. This modification moves the center of pressure of the elevator further away from the pivot and results in the stick forces being nearly double their original value. This does not make the controls overly heavy, merely more solid. We like the new elevator enough that we have made it standard on the 2nd edition of the VariEze plans. This is not a mandatory change for those of you flying, since most of you have adjusted to using the wrist for control and most of you like the light responsive control feel. However, many of you do feel that the elevator is a lot lighter than the ailerons and will like the better harmony provided by the wide-chord elevator. We do recommend that you extend the chord on any airplane that has not yet flown unless the pilot is confident that his proficiency in sensitive aircraft is good. The new elevator cross-section is shown, full size in this newsletter, along with a foam template to be used in original construction. Note that to retrofit you can merely add material to your completed elevator. This can be styrofoam with one ply BID @ 45 degrees on each side, lapping onto the original skin, or you can bond on balsa wood, carve to shape and cover with a light dacron or glass cloth. Use the templates to carefully check the shape of your elevator. Any variance in the shape can effect the trim capability of your airplane. For example one airplane, N37EZ had an elevator in which the bottom was kinked, as shown, not flat. This airplane exhibited a very strong climb tendency and had to be flown with a firm forward stick force to fly level. This airplane was extremely hard to fly and was overly sensitive. Now, after the elevator was extended to the new shape this airplane has excellent pitch stability and flies very solid.

Note that the new wide chord elevator is reflexed up at the trailing edge with the bottom flat. This is required so that the trim system has enough authority to trim hands-off at low speeds. Check Your

Elevators. If they do not have the correct cross section, your aircraft will be difficult or even dangerous to fly.

VARIVIGGEN ACCIDENT

The following report was written by Mike Melville who flew his VariViggen up to aid in the FAA investigation of this tragedy.

On 21 May 1978, Harold Reiss lost his life when his VariViggen N29HR crashed 1/4 mile off the end of runway 10 at Illini Airport, Indiana.

Burt called and asked if I would go to the crash site and assist the FAA in their investigation. I agreed and was on scene by noon the next day.

Along with the two FAA investigators we determined that there was no mechanical problem with the aircraft.

Flight and engine controls were attached and functional. There was fuel in the lines, the engine had good compression on all 4 cylinders and the mags were operational. The engine was running on impact as evidenced by prop blade failure due to powered rotation. The aircraft hit the ground 60 degrees nose down and 100 degrees angle of left bank. The canard hit first, followed by the left wing and nose. The canard came off in one piece and the fuselage failed at bulk head F20 and F32. The left wing failed down due to the 100 degrees bank angle. The S.P. wing outboard sections failed from foam crush and skin splitting at the leading and trailing edge. The outboard stub spar did not fail. The engine and mount was undamaged but the mount did push the F152 bulkhead about 12" forward but did not enter the passenger compartment.

Lack of any impact damage to the front canopy locks and outward failure of the canopy open retainer cable indicated the canopy was open on impact.

At the moment of impact Harold was struggling to close the canopy and still had his hand on the canopy bow after impact.

The FAA findings were that Harold took off with the canopy closed but not locked and at 300-400 ft alt on takeoff the canopy blew open.

Eye witnesses reported the aircraft pitched up and down rolled left and right before rolling left and pitching down into the ground.

The conclusion was that Harold became more concerned with the open canopy than aircraft control and crashed. He probably thought the canopy would come off and go through the prop. In actuality the canopy would not have come off and even when open would not have caused any unmanageable flight control problems. An old Air Force adage is certainly applicable in this situation:

---TO HANDLE ANY EMERGENCY---

(1) Maintain aircraft control.
(2) Analyze the situation.
(3) Take proper action.

NOTE THAT NUMBER ONE PRIORITY IS AIRCRAFT CONTROL.

On one occasion each, both Mike Melvill and Burt Rutan forgot to lock the Viggen canopy for takeoff. Mike's opened at 300 ft on climb and he was able to catch, close, and lock it inflight while maintaining control. Burt's opened during takeoff roll. He closed, locked it, and continued the takeoff. Do not assume it will not happen to you. If you are flying a Viggen or a VariEze, ground your airplane until you install the secondary catch.

Since both VariEze and VariViggen aircraft are both susceptible to the pilot taking off with the canopy unlocked we are asking all VariEze and VariViggen owners to install the secondary safety catch shown in CP15 pg 8. We consider this modification a mandatory safety change and ask your help to insure that all VariEze and VariViggen, are grounded until this safety catch is installed. The one we installed in N4EZ is simpler than the CP 15 design and is more positive - see below. Note that the safety catch will prevent the canopy from opening more than one inch even if the pilot forgets to lock it. To open the canopy normally, raise it one inch, push in on the catch then open. This works the same as the secondary catch on a car's hood. **SKETCHES OMITTED**

CP17, Page 6

VARIEZE ACCIDENT
On 3 July 1978, Jim Boyd was fatally injured in the crash of his VariEze about 18 miles south of his takeoff point (Klamath Falls, Oregon Airport). Dick flew up to Klamath to help with the investigation. The following is capsulization of what he found:

a. The aircraft impacted in a steep left bank (35 degrees plus) at least 20 degrees nose down at a high rate of speed. There was extensive damage to the left wing, canard and fuselage forward of the main center bulk head. All aircraft components were located at the crash site thus no in flight structural failure was indicated.

b. Observers thought that Jim was only going to make a high speed taxi test. Tower personnel reported he made one smooth and normal runway flight and landing then reversed direction, took off and departed the traffic pattern. Jim reported "he was indicating 145 MPH and going to the south practice area". The weather was 1500 overcast, good visibility at the airport but lower ceilings to the south with rain showers. One controller thought he saw Jim fly into a cloud. Local people living near the crash site said the weather was "bad" that morning. But exactly how bad could not be precisely determined. There was heavy rain on the wreckage between the time of the crash and when it was discovered some 5 hours later. No one observed the crash.

c. Jim had done an outstanding job of building the aircraft. Excellent workmanship was evident throughout. Even the interior of the cockpit was sculptured and finished with feather fill to a high gloss.

He had a VOR receiver, VHF com radio, transponder and a stereo cassette tape player. With that finish, a Continental 0-200 engine with alternator and a 25 lb battery the aircraft was considerably over weight. ???? lbs empty) other than the weight there were no builder discrepancies noted.

d. The prop was virtually undamaged. However, nothing could be found to indicate that engine could not produce power. Good compression, both mags normal, fuel on, filters clean, carb float bowl full of clean fuel. One reason for no power at impact could have been the key type mag switch was OFF and the key was out and found 20 feet away from the cockpit, indicating that the pilot had shut the engine down before the crash by removing the key.

e. Jim's friends including Larry Burton, the local EAA Designee, had all advised Jim to get someone more experienced or get more recent experience himself, before he flew his aircraft on its first flight. Jim was a commercial pilot with an instrument rating 200 hours total time, but he had not flown in the past two years except for a one hour biennial flight review the day before in a Cherokee 140. Jim had never flown an aircraft with a stick.

f. Jim's wife said he was very anxious, uptight and on kind of an ego trip that if "I built it, I can fly it". She said she tried to talk him out of flying it, "but you can only tell a husband so much". If it can be determined that the prop was stopped at impact, then it indicates that the aircraft at some time before impact was traveling at less than 60 knots and had the switch off or a fuel interruption. VariEzes windmill at speeds above 60 knots with fuel off or ignition off. Once the prop stops (below 60 kts) you then have to speed to above 120 knots to start windmilling again. This points to speculation that he was disoriented in clouds, since it would be highly unlikely that he was practicing stalls to below 60 Kts on a first flight with a low ceiling, particularly with ignition or fuel off.

FLIGHT TESTING - We continue to see examples of homebuilders not following recommended procedures in their flight testing. We cannot emphasize enough that the information in the owner's manual and newsletters is based on actual experience with our aircraft and that of other homebuilders. Do not expect success unless you follow all the recommended procedures! We are summarizing a checklist below of some items from previous newsletters. Be sure to follow all of them.

CHECKLIST FOR INITIAL
VARIEZE FLIGHT TESTING

1. Follow Appendix I of 2nd edition Owners Manual to the letter for inspection and weight/balance.

2. Check that canard is trimmed to 142" unless limited by fwd cg ("CP" 14).

3. Check elevator dimensions and contour of canard and elevator ("CP" 16 & 17). Wide chord elevator is recommended.

4. Canopy latches, seals and locks must be secure. Hood latch (page 6) must be installed.

5. Fuel system - valve must work smooth & positive. Use full fuselage tank and 6 gal per wing for first flight.

6. Weight must be below 900 lb gross. Cg should be in the forward part of the first flight box for first flight ("CP" 14 & 13).

7. Remove all equipment not absolutely required for flight, to get weight as light as possible. Do not fly first flight with a starter or alternator - These are double-penalty items, requiring nose ballast to get to the fwd cg for first flight ("CP" 13 & 14).

8. Airport must be smooth surface, runway length at least 6000-ft to allow runway flight. 4500-ft at sea level is absolutely minimal (Owners manual).

9. Pilot proficiency - current and comfortable in at least two different types - one should be high performance. Runway flights in two types made before conducting tests ("CP" 12 & owners manual). Note..., that the VariEze is a high performance aircraft and is "hotter" on takeoff and landing speeds than the slow training type aircraft. Do not try to learn proficiency at the same time as you are making flight tests on a new airplane. "Learning to fly in a VariEze is like learning to drive in a race car or learning to ride on a competition dirt bike." Study the owners manual before beginning tests.

10. Weather - See owners manual. Ceilings should allow glide to the airport during the entire first 25 hours of testing, preferably first 50 hours.

11. Stay in the traffic pattern or in radio/visual contact with your ground crew or be sure to have a chase if you depart the airport traffic area. Flight testing is not something to be done alone.

12. Check your mental state; be sure you are calm and can think straight. Ask someone else to evaluate your state of mind. Be sure your "ego" doesn't get in the way of good judgement. If all is not well fix it first, then fly (mechanical or mental). Above all don't let a big crowd, TV/news reporters pressure you into anything dumb. Best to have no spectators, just minimum necessary ground crew.

13. Wear a parachute and be at least 8000 ft AGL when expanding your high speed envelope above 160 mph or when expanding your low speed envelope below 70 mph.

VARIEZE PLANS CHANGES - Incorporate these NOW

Owners Manual Appendix I	Add "check freedom of fuel valve. If it requires more than 5-lb force at handle the valve must be overhauled. CAUTION - if valve is selected between wings and fuselage position, the fuselage tank will drain into the wings."
Newsletter II	Substitute a AN 525-832-12 screw and a AN

pg 6 & Section IIC pg 8	364-832 nut for the rivet that attaches the universal to the valve. This allows easy removal of the valve.
Section I Chapter 22	Add: The hood-catch shown on page 6 of this newsletter is mandatory and must be installed before flight. This protects the pilot should he takeoff without locking the canopy. Do not omit.
Section I pg 17-9	Refer to the two AN3-11A bolts on NG11. The aft bolt should be installed with the head on the bottom to definitely avoid it interfering with the NG14 spacer when the gear is locked down check for positive clearance in the down position. Grind material from NG14 if necessary to provide clearance. We have determined that this interference, (which prevents NG11 from reaching its full locked position) is the cause for the inadvertent nose gear retractions during taxi that were reported in previous newsletters. Confirm this clearance, even if you have had no trouble with yours.
Owners manual pg 30	Add "torque prop bolts 180 inch-pounds"
Section I Chap 5 (1st edition only)	Add "refer to CP17 for the recommended (not mandatory) wide chord elevator."

BUILDERS CLUBS - Bob Zahner, 906 Millard, Tallahasse, Fla. 32301 is organizing a VariEze builders club for Florida and South Georgia - contact him directly.

QUESTIONS/ANSWERS

Q. I see that when you shut the engine down on the 0-200 Continental VariEze that the prop stops windmilling if you slow to below 60 knots and stays stopped until you increase speed above 120 knots. Is this true of the Lycoming too?
A. Probably not, since the compression is more. Ken Swain has the extra high-compression 0-235-FZB in his EZ and reported that when he stopped his he had to go to nearly red line speed to restart. We suspect that the 0-235 C will windmill down to about 70 knots and will restart at about 150 knots.

Q. Do you advise doing the speed brake depression when carving the fuselage in chapter 12?
A. No. This is best done later, exactly as shown in Section VI.

Q. I'm now using the CP16 pg 9 method to jig the winglets to the wing. I've noted that this method results in the top of the winglet being further inboard than the plumb bob method. Is this intentional?
A. Yes. We failed to mention that in CP16, but we did intend to remove some of the 'cant' to reduce dihedral effect. The EZ is less susceptible to wing rock at low speeds and is a bit easier to fly with

rudders with some dihedral effect. The Defiant's winglets cant inward from vertical about 3 inches. Some builders have found some mis-match of the winglet incidence template at the trailing edge and rudder hinge line. This is of no concern since the incidence template is not needed when using the CP16 method.

Q. Good to see that the new CP16 method of attaching the NG15 to the strut has eliminated the holes thru NG1 giving it full strength. My problem is I have already drilled the two holes thru NG1. Do I have to buy a new strut?
A. No. If you remove NG15 and shorten the strut about 3/4-inch you can reinstall it exactly per CP16 and obtain essentially full strength, since the old hole will be well within the socket. This makes the aircraft sit 0.5 degrees lower during taxi (no problem). Remember, the new method eliminates all holes thru the strut at the lower end. The strut is no longer the weak point in the nose gear. The fork or NG10 will now fail before the glass strut.

Q. I am considering adding a few extra plies of glass in a few areas to beef them up for extra strength is this OK?
A. No! More than likely the extra material will not be added where first failure will occur anyway. The extra weight in most places will actually weaken your airplane in that its maximum 'g' capability will be less and failure on hard landings will be more likely. The best thing you can do for optimum safety is to do perfect workmanship with the exact ply arrangement in the plans. Also, stiffer structure can change flutter modes.

Q. I am having trouble getting a smooth hole drilled in fiberglass on diameters over 1/4", any suggestions?
A. Yes. A piloted spot-face, countersink, or counterbore bit works excellent. In fact this should be considered a must on the 1/2" holes in the landing gear tabs. These are very difficult to do adequately with a drill bit.

Q. I want to find out exactly how much the VariEze materials and prefab parts cost, and how much optional prefab parts are available. How do I find this? A. Refer to the flyer in this newsletter. Contact each distributor and obtain his catalog for price and availability. Its generally best to study the plans carefully to decide if you want to build or buy the prefab parts. If you build most of them yourself you can save a great deal.

SHOPPING - Aircraft Spruce & Wicks report that all VariEze materials are readily available with no major backlogs. They have the Composite Introductory Kits in stock for immediate delivery.

Ken Brock - no major backlogs; plenty of new 3-inch prop extensions and face plates for wood props are in stock. Be sure you are using the correct face plate for your wood prop. Minimum thickness is 1/4" to avoid local crushing. Ken also has NG25 and NG26 in stock now.

Jiran - all items now being shipped well within the 8-week backlog. Fred reports that the prefab VariEze wings and center spar should be into static test within 3 weeks with flight tests to follow. These may be available in Kevlar, to save weight. Jiran also reports that he has produced a prototype vacuum - bagged Kevlar cowl for the VariEze. These

will be expensive, but at a 10 lb savings it may be justified for you guys with the big heavy engines.

Canopies - we finally have a solution for those who have been complaining about how expensive it is to get a canopy out to the east coast. Walt Hoy of The Airplane Factory, 7111 A Brantvista Ave., Dayton, Ohio 45424 (513) 845-9872 or (513) 233-7754, who has been building VariViggen canopies for the last 2 years is now producing an excellent VariEze canopy. Compared to the original, it has a bit more forward-cockpit head room and visibility. Walt also offers a 1/2-price replacement for any breakage within the first two years. Send Walt a self-addressed, stamped envelope for his flyer on the EZ canopy. We have a Hoy canopy here at RAF if you want to inspect it. Cowley has notified us that he is phasing out the canopy production, but will still have some available for the next 2 or 3 months.

CP17, Page 8

VARIEZE HINT FROM NAT PUFFER:

"If you wish to get a tight seal where the exhaust pipes exit the cowling, and still be able to remove the cowling easily, especially if you curve the exhaust pipes aft as I did - make a gasket plate that stays with the exhaust pipes where you remove cowling. It takes only a few flat headed screws and nut plates to hold the gasket plate to the cowling when assembled. Rivet assembly together on exhaust pipes.

This is a custom fitting job, but it gives tight seal, makes cowling removal easy, and allows more freedom in configuring pipes to individual taste. Also it relieves bending forces on cantilever pipes; especially if you do this, as I did on the right side. **SKETCHES OMITTED**

VARIVIGGEN - Mike and Sally Melvill have really been giving their Viggen a workout. They visited RAF in May during a 6000-mile trip (see photo on cover). Mike and Sally were alternating front/back seat pilot chores. They were loaded down with baggage and handled a 9000-foot density altitude takeoff at Albuquerque with no problem. His summary after arriving home "once again the Viggen has proved to us what a really practical cross-country machine it is. We love it and would not trade it for anything".

Mike designed and built a very clever angle of attack instrument for his Viggen. Instead of a potentiometer on the vane (the one that's so hard to find) he made up a wiper with 3 electrical contacts. These go to 3 lights on the visor arranged in a vertical format. When the center light is on (green) the airplane is "on speed". When the top light is on you are too slow, too fast if the bottom one is lit. This system automatically makes you fly the correct approach speed regardless of weight. It works exactly like the indicator lights in an F-4 jet fighter, yet Mike built it for $5.00! Mike, how about a drawing of this for CP#18?

We have no reported VariViggen plans changes since CP16. We have been able to inspect the Melvill drawings for the worm-drive main gear modification. They do add some complexity, but in the long run we feel

that it's well worth it. We highly recommend it and plan to incorporate it when the Viggen plans are updated in the 2nd edition.

Jesse Wright is continuing to provide a very beneficial service in helping Viggen builders with his well-built parts and installation instructions. Thanks, Jesse - we've gotten a lot of compliments on your parts (Jesse's address is on the Viggen flyer).

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

N4EZ & N7EZ. Photo taken from Ed & Jo Hamlin's EZ over the Mojave desert on the way to lunch.

Frank Tomko's Viggen at rollout!

John Poehover's Viggen, ready for paint.

Quickie. N77Q now has been refinished for Oshkosh.

COMPARISON
GRUMMAN COUGAR and RAF DEFIANT

SPECIFICATIONS	COUGAR	DEFIANT
Number of seats	4	4 + 2
Engines, Lycoming	160 hp	160 hp
Props	73" c/s	69" fixed
Span	36', 10"	29', 2"
Wing area	184 square ft	127.3 sq ft
Wing loading	20.7 psf	22 psf
Power loading	11.9 lb/hp	9.06 lb/hp
Empty weight (IFR)	2645 lb	1585 lb
Useful load	1155 lb	1315 lb
Gross weight	3800 lb	2900 lb
Payload with full fuel	459 lb	775 lb
Full fuel	696 lb	540 lb
Fuel with 4 175-lb people & 75-lb baggage	375 lb	540 lb
PERFORMANCE		
Max rate-of-climb at gross	1200 fpm	1750 fpm
Single engine R/C with one feathered, gear up, blue-line speed & best flap angle	280 fpm	390 fpm
Single engine R/C initially at failure, gear down, prop windmilling, flaps down	negative	+340 fpm
Max cruise 75%	165 kt	NA
65% cruise (max for Defiant)	154 kt	188 kt
Miles per lb fuel at max cruise	1.58 nm/lb	2.08 nm/lb
Range, full fuel, max cruise, no res	1100 nm	1120 nm
Range, with 4 adults & 75-lb baggage, no reserve	593 nm	1120 nm

Stall speed clean	68 kt	64 kt
Stall speed ldg. config.	61 kt	64 kt
Stall speed with 2 crew & 1/2 fuel	57 kt	56 kt

The RAF hangar is located on the west end of the flight line at the Mojave airport, Mojave Calif, approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any part for our comments. We are normally open from 9 to 12 and 2 to 5 on Wed thru Sat, but you should call first to check, since with the fly-in season starting we will be gone a lot.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, it's best to keep it separate from a request for an answer to a builder-question. Mark the outside of your envelope "builder question". This will speed our reply.

FULL SIZE WIDE CHORD ELEVATOR TEMPLATES OMITTED

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft stick	49 mph
	Landing	500 ft
Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 square ft
	Wing Span/Area	19 ft/119 square ft
	Empty Weight	950 lb
	Gross Weight	1700 lb
Performance with 150-hp. Special Performance Wings Specifications	Climb	1000 fpm
	Cruise	158 mph
	Wing Span/Area	23.7 ft/125 square ft
Special Performance Wing	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY

The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73, and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips." Gas service and other airport services have been better, too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS:

AIRCRAFT SPRUCE & SPECIALTY CO, 201 W. Truslow, Box 424, Fullerton, Ca. 92632 (714) 870-7551.
VariViggen spruce kit, plywood kit, hardware, aluminum and fiberglass. Catalog cost $2.

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680 (714) 898-4366.
VariViggen prefabricated components: all machined parts. Catalog costs $2.

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave, Dayton, Oh 45424.
VariViggen plexiglass canopy.

MONNETT EXPERIMENTAL AIRCRAFT, INC, 955 Grace St, Elgin, Il 60120 (312) 741-2223.
VariViggen molded fiberglass parts.

GOUGEON BROTHERS, 706 Martin, Bay City, Mi 48706.
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS, 4102 Twining, Riverside, Ca 92509.
VariViggen welded nose and main landing gear, 1-1/4" sq. steel tube.

MIKE AND SALLY MELVILL
Part Two of Construction Manual
Box 561, Frankton, Ind. 46044

JESSE WRIGHT (VariViggen builder), 7221 S. Colorado Ct, Littleton, CO 80122 (303) 771-5140.

VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price: $10.00 first class mail, $11.50 air mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price: $6.00 first class mail, $7.50 air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, & flight reports as possible. Details mandatory, desirable, & optional changes to plans & to owners manual. A newsletter subscription and all back issues are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price: $4.75 per year first class mail, $6.50 air mail overseas. Back issues: $1.00 each

VARIVIGGEN PLANS - NASAD approved in "AA" category. Sixty-one sheets, completely detailed. Also included are builder's handbook information, step-by-step construction guide, complete bill of materials, flight operating limitations, parts lists. Section breakdown: 1. Introduction, 2. Operating Limitations, 3. Bill of Materials, 4. External Geometry (Lofting), 5. Building Tips, 6. Construction Order & Methods, 7. Canard & Elevator, 8. Fuselage, 9. Inboard Wing, 10. Verticals & Rudders, 11. Outboard Wings, 12. Cockpit & Seats, 13. Canopies, 14. Flight Control System, 15. Fuel System, 16. Angle-of-Attack System, 17. Engine Mount, 18. Cooling & Cowling, 19. Landing Gear, 20. Gear Doors, 21. Electrical System, 22. Parts List. Also included are the tech report & photo described. Price: $53.00 first class mail, $59.00 air mail overseas.

VARIVIGGEN SPECIAL PERFORMANCE (SP) WING/RUDDER PLANS - Construction drawings and assembly manual for glass composite outer wing panels and rudders. These are optional wings, replacing the aluminum surfaces shown in the VariViggen plans. The SP wings are easier to build and provide increased climb and cruise performance. They also have fuel tanks which increase range to over 600 miles. Price: $39.50 first class mail, $41.50 air mail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18%-size radio-controlled model airplane built & flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment & engine in the .35 to .65-cu. inch size. 555-sq inch wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price: $4.75 first class mail, $5.50 air mail overseas.

VARIVIGGEN CONSTRUCTION MANUAL Part 1 of a photo-illustrated construction manual, written by Jim Cavis, S/N 31. Includes fuselage,

canard, inboard wing, vertical stabs, control system, and landing gear, along with approximately 100 photos. Part 1 also includes helpful sketches on jigs and numerous building tips. The written information is similar to plans chapter 5, except expanded to about 30 pages. Price: $18.50 first class mail, $20.50 airmail overseas.

CP17, Page 12

VariEze

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $2600 (less engine) in about 1000 man-hours, or from prefab parts and materials, costing approximately $4000 in about 600 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair. The VariEze uses the small four-cylinder Continental aircraft engines. The 0-235 Lycoming, stripped of starter and alternator, is now being tested and should be available soon. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 20 gallons of fuel. Frontseat passengers up to 6', 7"/250 lbs and backseat passengers up to 6', 5"/220 lbs can be accommodated plus a modest amount of baggage in two custom suitcases. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (60 kt/70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE TEST PROGRAM The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included

basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE HOMEBUILDER SUPPORT The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$139.00	$153.00
Section IIA	$19.00	$21.00
Section IIC	$21.50	$23.50
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95
Add 6% if Calif resident - newsletter is not taxable.		
*U.S. FUNDS ONLY		
TOTAL		

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

SECTION IIA - Continental A65, A75, C85, C90, 0-200

SECTION IIC - LYCOMING 0235 - No accessories.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS & PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP @ GROSS WEIGHT:

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	560 lb
Gross Weight	1050 lb
Range @ Max Cruise	700 mi
Range @ Econ Cruise	850 mi
Min Speed (full aft stick)	55 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6 square ft
Canard Span/Area	12.5'/13 square ft

SPECS & PERFORMANCE WITH 75-HP CONTINENTAL:

Take Off	1050 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	530 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

AIRCRAFT SPRUCE & SPECIALTY CO. or WICKS AIRCRAFT SUPPLY
201 W. Truslow Ave, Bx 424 410 Pine
Fullerton, Ca. 92632 . Highland, Il. 62249
(714) 870-7551 (618) 654-7447

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680 (714) 898-4366: Prefabricated components - wing attach assembly, nosegear

machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, 6 Mojave Airport, Mojave, Ca 93501, (805) 824-4558: Prefabricated components - cowling, fuel tanks, wheel pants, maingear & nosegear struts, strut cover & nosegear box. Send SASE with 3-oz postage for brochure.

THE AIRPLANE FACTORY, 7111A Brandtvista, Dayton, Oh 45424 (513) 845-9872 or 233-7754 - Canopy.

H.C. COMMUNICATIONS, Bx 2047, Canoga Park, Ca 91306, (213) 882-0422. Custom COM & NAV VHF antennas.

COWLEY ENTERPRISES, 170 Mojave Airport, Mojave, Ca 93501 (805) 824-2368. Canopy.

N4EZ and N7EZ over the Mojave Desert. Photo by Don Dwiggins. N4EZ flown by Burt. N7EZ flown by Burt's brother Dick. Rear seaters are Carolyn and her 13 yr old daughter. **PHOTO OMITTED**

THE CANARD PUSHER NO. 18 OCT 78

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If you are building a VariViggen you must have newsletter 1 through 18. If you are building a VariEze from the first edition plans you must have newsletters 10 through 18. If you are building a VariEze from the second edition plans you must have newsletters 16, 17 and 18. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave airport, Mojave, Calif., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any part for our comments. We are normally open from 9:00 to 12:00 and 2:00 to 5:00 on Wednesday through Saturday. If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder question." This will speed our reply.

RAF ACTIVITY since the July newsletter has included the Oshkosh EAA convention, completion of the basic flight tests on the Defiant twin, work on updating the VariEze section IIA and VariViggen plans, and builder support.

We are very happy to report that Mike and Sally Melvill (builders of N27MS, the beautiful VariViggen seen at Sun-N-Fun and Oshkosh) have moved to California and joined us here at RAF. Mike is now responsible for builder support on the VariViggen and is helping Burt by assisting VariEze builders. He is busy preparing the 2nd edition of the VariViggen plans, and will soon start building a VariEze. VariViggen builders are invited to RAF to inspect Mike and Sally's VariViggen. It has immaculate workmanship. It has composite glass/foam standard wings with wing tanks, full IFR panel, and is powered by a 180-hp Lycoming. Mike and Sally have used N27MS extensively for travel, logging 230 hours in the first year.

OSHKOSH 78 - Twenty-four VariEzes, one Quickie, and one VariViggen flew to Oshkosh, Wi., in July for the annual EAA flyin. It was quite a sight to see them together, particularly in the fly-bys. Mike's VariViggen and thirteen EZ's were airborne in the fly-by pattern at one time. The Quickie, EZ, and Viggen joined up in formation for airborne

photos to be used in "Poplar Mechanics" magazine. Fred Keller flew in from Anchorage, Alaska in his beautiful EZ that won our "Best VariEze" trophy and also the convention's "Best workmanship" award - this is the first time the workmanship trophy has gone to a composite aircraft. Fred's finish is flawless, yet his empty weight (no generator) is only 590 lb using the C-85-12 Continental. He attributes this to very careful and accurate foam core assembly with a minimum amount of micro used in core assembly and finishing. Maybe we can talk him into writing some words on his techniques for a future newsletter. Fred built most of the prefab parts, himself, keeping his total cost (including engine and shipping to Alaska) under $6000. Congratulations, Fred, for a well done project, and thanks for sharing it with all of us at Oshkosh.

Daily VariEze bull sessions were held at the EZ's on the flight line the first five days of the convention. Builders would ask questions and each of the EZ pilots would answer giving his experience. These were very educational for all. Subjects ranged from stall characteristics to UFO reports. A summary of the bull session information is shown later in this newsletter.

The first running of the Lowers-Baker-Falck race was during Oshkosh 78. This is actually an efficiency contest much like the Indianapolis 500. At Indy the cars are given 280 gallons of fuel for 500 miles. For the LBF race, the airplanes must finish 500 miles on less than 18 gallons of fuel. Four airplanes were entered: Steve Wittman with his Bonzo formula racer, Ken Rand with his Turbo KR2, Ken Swain, with his Lycoming-powered VariEze, and Dick Rutan with N4EZ, RAF's Continental 0-200-powered VariEze. None of the racers could run wide open, since they would burn more than 18 gallons and thus be disqualified, thus, the pilots had to carefully plan and adjust their speed. Any fuel left over (less than 18 gal) could be added to the speed at 1 mph-per-lb fuel. The 'O1 master' Steve Wittman won easily at an adjusted speed of 199.8 mph (fuel remaining 19.5 lb). Dick Rutan was second with an adjusted speed of 168.5 mph (fuel remaining 6 lb). Ken Swain was third with an adjusted speed of 157 mph (fuel remaining only 0.5 lb!). Ken Rand was disqualified for using too much fuel (10 lb over the 18 gal), his adjusted speed was 147 mph. Next year there is a four-gallon (24 mph) advantage given for two-place airplanes, so we can compete more favorably with the racers.

We want to thank the eager and able volunteers from the Minnesota VariEze club (see "CP" 14 for a list of clubs), who helped us throughout the Oshkosh week in our booth: George Wilson, Vic Berggren, Jim Tome, Cliff Johnson, John Novy, Earl Freeman, John Benjamin, Dennis Mitchell, Nat Puffer, and Ed Wieland. Jim Tome was the one who occasionally sported the "Darth Vader" costume. Nat Puffer's VariEze was the first to arrive and last to leave.

COMPOSITE WORKSHOP - VARIEZE, VARIVIGGEN, & QUICKIE
We are planning one more composite construction seminar. This will be done jointly with Quickie Aircraft, Inc., since the VariEze, VariViggen, and Quickie construction methods are similar. The seminar will be held at RAF, hangar 13, Mojave Airport on Saturday the 25th of November. There will be flight demonstrations of the Quickie, EZ, VariViggen, and Defiant between 10 and 11 AM. The workshop will run from 1 PM till 6 PM. Sandwiches prepared by the local Rainbow girls

will be available for lunch. Builders are encouraged to bring parts of their airplanes. If you have a part in which you are unsure of its workmanship or acceptability, bring it so it can be inspected or used to educate others. Mojave Airport is a two-hour drive north from Los Angeles on Highway 14, 25 miles on a 335 radial from Palmdale Vortac. Bring folding chairs if you can.

CP18, Page 1

A letter from Nat Puffer.

Dear Burt and Carolyn,

This is a special "thank you" letter. The VariEze has really changed our lives. Much has been written about how easy and satisfying it is to build a VariEze, and much has been written about how delightful it is to fly a VariEze. With all of this we concur. But not enough has been said about how owning and flying a VariEze can change your personal lives.

When you are building an airplane, you live in relative obscurity, except for other builders. You tend to shun social obligations, to get the plane done, and tend to drop out of things going on around you. But once the airplane is completed, especially a VariEze, it is an instant passport to fame. You become an instant celebrity! It is very ego building and in stark contrast to what has gone before.

It starts with offers of free use of airplane trailers, free hangaring and/or reduced rates. Very prompt attention from the FAA, etc. Every time we open the hangar doors, an instant crowd of admirers gathers. People come back time and time again, and just stand and look. Special recognition by the control tower. All kinds of people anxious to help in anyway possible.

Being reported as a UFO, and being interviewed on the radio. Being the subject of a sound movie, and being interviewed on the local TV station.

At Oshkosh, receiving a very warm and friendly reception by the control tower, and being personally escorted to a parking space right in front of the main gate. Being asked to participate in a fly by. Being asked to participate in photo flights in formation for Popular Mechanics, National Geographic, and Sport Aviation. Being asked to announce on the Oshkosh PA system for the VariEze fly by just before the airshow.

On the return home from Oshkosh, having Mpls Flight watch carry on a running conversation for 90 miles asking if I would land at Mpls. International so they could see my VariEze.

At Voyageur Village being swarmed with kids. At a local fly in at Osceolla, drawing the crowd away from all the other airplanes. Not being allowed to pay for my gasoline. Having the 3M employee Magazine editor asking for an interview, and having to fly a special photo flight for the company photographer.

Having everyone who flies in the other plane on a photo flight ecstatic over how much the VariEze excels any other plane in the sky. (I make gunnery runs and fly circles around the chase planes). Being very proud to be a part of the VariEze program.

Best of all, how ecstatic my wife is about being a part of it all, and how she simply eats it up! She delights in explaining all the intimate technical details to people, and how wonderful it flies. (She has never even had her hands on the stick and would be terrified if I asked her to fly).

There is no indication that any of this will ever let up. It has truly been one of the nicest things that has happened to us in our life time, and we owe it all to you, Burt and Carolyn.

Very truly yours,
Nat Puffer.

THE DEFIANT PROTOTYPE has now completed its basic flight test program, including high angle-of-attack tests. It has been equipped with a full IFR panel of King equipment, including their new integrated VOR/LOC/GS/DME/ RNAV KNS80 NAV system. It has logged 120 hours in its first three months, including trips to St. Louis and Las Vegas for the NBAA and AOPA conventions. Its longest leg was 1032 nm (1188 miles), flown at 12,500 ft at an average speed of 184 kt (212 mph), using 84 gal of fuel. It has been flown to 28,350 ft altitude. It can fly at 174 kt (200 mph) at 20,000 ft, with an economy of 13.2 nm (15.6 miles) per gallon! Rather than use the "CP" space to describe the Defiant we refer you to several articles and pilot reports to be printed within the December issues of "Flying" and "Air Progress" magazines. Defiant will also appear in "National Geographic" within the next year. We are presently gathering information to assist us in deciding how to proceed with the Defiant. Should we decide to do the type certification program ourselves, we may be soliciting investors to assist in financing the certification effort. If you, or someone you know may be interested in this as an investment, please write to Rutan Defiant, Building 13 Airport, Mojave, Ca. 93501. We will supply an introductory bulletin and contact you, should we require investors.

VARIVIGGEN NEWS - by Mike Melvill
The big news for potential 'Viggen' builders, at least, is that the plans for the VariViggen are being updated, corrected, improved and reprinted in a second edition. These plans will be more like the VariEze plans, in that there will be more "how to" instructions covering each chapter with photographs, wherever possible. Engine baffles will be shown full size in most cases with photos to clarify where each part goes. We will be incorporating all valid parts from Parts I and II of the VariViggen Construction Manuals. Photos and words from both parts will be included in the appropriate chapters. All corrections and revisions from newsletter #1 through #17 will be included. The foam-fiberglass composite S.P. wing, composite standard wing, rudders, ailerons, will be in the new edition. Also, since so many people have had problems with the cable system on the main gear, we will be incorporating the worm gear drive as used on my Viggen N27MS. This system has worked flawlessly for over a year now, the aircraft has 230 hours and 260 landings on it, with absolutely no problems. We will have the bearings, gears and machine parts available

at our normal distributors. The new edition of the VariViggen plans should be available by late November, 1978 and will consist of approximately 120 pages and will cost $165.00 Now that we have a VariViggen on permanent display here at R.A.F. it is available to all builders to inspect and compare. Hopefully we will be able to get the Viggen builders to start contributing to the newsletter again. We know there are a lot of active builders out there so how about it guys? Send in something for the newsletter. That is the only way we can get feedback and so help others who are building. We have had only 20 replies as a result of the requested survey in CP #16 so far. (Please send them in guys, it only takes a few minutes of your time, and it really is a big help to us). Even such a small number is still interesting and shows quite a wide distribution of Viggens through 14 states and three different countries. There are at least three Viggens flying now with several close to flying. The majority of those who sent in their survey replies appear to be between a year and two years away from flying. Wally Warners Viggen N455VV is once again airworthy after a main gear up landing sometime ago. Jim

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Edgar of Columbus, Ohio, has begun his flight tests. John Poehner of Flushing Michigan, has his Viggen N29X, painted white and ready for first flights. He is awaiting hanger space.

My own Viggen, N27MS, has flown coast-to-coast and been to many states, as well as Florida's Sun 'n Fun and Oshkosh, where I had the opportunity to meet and talk with many of you Viggen builders. Both myself and my wife Sally are working full time here at R.A.F. and we are both looking forward to meeting more of you. Feel free to call or write either of us with your questions and or problems. Some of you have sent in suggestions and been disappointed when it was not printed in the newsletter. We have to decide what will be of help to the average builder and we have to avoid printing anything that may be confusing. Anyway, take heart and keep in touch with us, contrary to what some of you think, Burt has not abandoned the Viggen builders, quite the reverse, viz: new Viggen plans, Mike and Sally and N27MS hired on etc. We need to get the Viggen builders fired up again, it is a fine aircraft and you will love it when you start flying yours! I just recently learned to roll mine, and it is really quick and so easy to roll I wish I had learned earlier. I had not rolled it prior to coming to Mojave, as I had had no aerobatic training, but with instruction from Burt's brother Dick, I have been finding out just what a super handling aircraft the Viggen is. Dick's comment after his first flight in N27MS was, "That is the most responsive airplane I have flown since I quit the Air Force, I love it!"

Viggen builders should note the drawings for Mike's three-light angle of attack system shown later in this newsletter. This indexing system gives precise approach information without requiring the hard-to-find low-friction potentiometer.

VARIEZE SECTION IIA is now in its second edition after extensive modification to incorporate the three-tank fuel system ("CP" 11), revised exhaust systems, and some recent improvements to improve fire resistance and water removal. This involves moving the fuel valve

forward of the firewall, adding a gascolator (better water removal and removal of contamination-replaces the filter), and using a fire resistant line ("CP" 16) to the carb. There have been no VariEze fires, but we still think it's best to have the system meet FAR part 23 fire resistance requirements. These improvements are shown later in this newsletter, so those building from first edition IIA plans can update your drawings. Note that the valve is now a Weatherhead Delrin-spool type, to eliminate the valve sticking problems that occurred with the earlier Imperial valves. Our thanks to EZ builder Gordon Wright of Fort Jones, Ca., for suggesting the Delrin valve. Our tests show it to be compatible with avgas and to have excellent operating forces. Note that the improved fuselage tank now has its outlet in the front allowing positive water removal in the nosedown parking position.

SURVEY OF EZ'S FLYING - "CP" 16 included a data sheet. Enough of these have now been received to show some average results. Most of the approximately 100 owners that are flying have not supplied the information. Please do so, so we can get a better statistical average. The data is plotted below vs. engine horsepower. It shows that the average VariEze with a Continental is 30 to 50 lb overweight, 100 lb overweight for the Lycoming. Most of the airplanes over 650 lb are either loaded with equipment or are built with excess material than that shown on the plans. Remember, excess equipment or excess structure actually weakens the airplane. It can pull less 'g' and will fail more easily on a hard landing. The strongest airplane all around, is one built with all materials like the plans, with good workmanship, and kept as light as possible. Note that 25% of the airplanes (16% of the Continentals and 100% of the Lycomings) are over 650 lb empty. These are either single place airplanes or, at best, marginal with two people. The biggest surprise here is that all the Lycoming airplanes are overweight. The 0-235 weighs only about 15 lb more than a similar equipped Continental 0-200, and it is mounted closer to the cg, so we had expected similar empty weight. One possible reason is that some Lycomings are using mechanical and electric fuel pumps, but even this does not explain the large differences. So, those builders using 0235's have a goal - - who's going to be first to build a 600 lb. Lyc. EZ? It would be a performer, no doubt. Note that the lighter 0-200 airplanes will out-perform the average 0-235 airplanes. We do prefer the Continental if you can find one. The other plots show that, while some airplanes are meeting the performance shown in the Owners Manual, the average EZ is 12 mph slower, requires 170 ft more takeoff distance, and climbs slightly less. All responding commented that the owners manual adequately prepared them for first flights. While two owners reported they could beat the published landing distances, many listed long runway requirements under "dislikes", along with small baggage space, inability to use gravel and grass runways, low useful load, and forward visibility during landing. The owners listed the following under "what do you like most?" speed, fun machine, range, safety, economy, climb, appearance, everything, visibility, comfort and EZ to fly. All response under "problems or failures" were items that have been covered in previous newsletters. **GRAPHS OMITTED**

WEIGHT AND BALANCE - There have been several instances where builders have flown airplanes in a dangerous tail heavy condition because of

erroneous weight and balance data. This has occurred generally when using bathroom-type scales. Because of this we are now recommending that the measurements be done on a good platform scale. Only one is required, as long as two other stands are used under the other wheels so that the aircraft is level for all three weighings. One of the problems in weighing an EZ is that the main gear spreads out when the airplane is lowered onto the scales. This binds the scale sideways. To avoid this, align the scale so its wheels are pointed to the side or use two aluminum or steel plates under one wheel. Apply a generous glob of grease between the plates. This allows them to move sideways without binding the scales.

NEW DESIGN NG15 TESTED - The lower nosegear strut attach casting on the VariEze has been a problem for many builders. Last March it was solved with the addition of the NG25 plate and elimination of the bolts through the strut (CP16). Recently Brock ran out of the NG 15 castings so we made new tooling for it to improve its fit to the strut and to eliminate NG25. This new part (NG15A) fits over the strut and has a full length bottom plate that bolts on with four bolts (see photo). The entire strut and fork assembly was tested to more than 80% over the FAR Part 23 requirement without failure. The new NG15A is available now from Brock for new construction. Retrofit is not required provided your old NG15 is installed per "CP" 16 using NG25. Strength is equivalent.

VARIEZE PROPELLERS - John Benjamin, 973 Nissley Rd, Lancaster Pa 17601, is now producing and marketing the Sensenich Propeller for the VariEze (model W58LKL67). We have tested this prop extensively on N4EZ. Its performance is very similar to the Ted's prop and it appears to be quieter. Quality is excellent with 15 laminations and a plastic leading edge.

BUILDER HINTS.
Engine Instruments - The Westach Cylinder temp system is not temperature compensating. This fact is not clear in their supplied information. This system measures temperature differences between the probe and the wire junctions, with zero difference referenced to 70 degrees F. Thus, on a hot day with the wire junction temp of 100 degrees, the gage will read 30 degrees too low. At 40 degrees it reads 30 degrees high. Many, including us, have found the Westline oil pressure system to be unsatisfactory. We recommend a direct-type system for oil pressure.

3M makes a "white cap system" that may provide sufficient protection for those people who are sensitized to epoxy fumes. This is a helmet with a fresh air pump and filter. For details write, Occupational Health and Safety Products, 3m Company, P.O. Box 8327, Dept F3, St. Paul, Minnesota 55113.

Tach wiring - Plans show the electric tach wired to only one magneto, such that mag drop is only indicated on one mag - the other is done by 'ear', comparing it to the other mag. If you want to measure the drop on both mags do not hook the tach to both mags. Nat Puffer flew his first ten hours with a missing engine due to this. He came up with an excellent solution, which substitutes a double pole switch for one of the single pole mag switches. Wired as shown it switches the tach to

the mag being checked during the runup, with no "crosstalk" between mags.

Tires - we have seen several instances where the two ply VariEze tires have broken down before wearing out. Be sure to keep proper inflation - 55 psi on two ply and 65 psi on four ply. Replace the two ply tires after 60 landings even if not worn out. Better yet, use only the four ply rated tires.

Rod Ends - Reminder from "CP15" Page 4: we recently observed an airplane with a rod end that had been bent when installing the canard. Be extremely careful when the pushrods are loose that the rod ends are not stressed (bent). If you even suspect that a rod end has been slightly bent, ground your airplane until it is replaced. Nylon Control Conduit - we have an indication that incorrect material was shipped to some customers during the spring of '77. This was .039 wall nylaseal rather than the correct .025 wall nylaflow. Check yours, the 3/32 cable will not fit the incorrect tubing.

Epoxy Pump - when changing from fast to slow hardener merely hold the resin lid on while you tip the pump to pour out the hardener. Refill with correct hardener. The mixture of fast and slow obtained by residual material is good - no problem.

Fiber Orientation - at least two builders have built wings with all the UND plies parallel to the T.E. rather than one parallel to the L.E.. Be careful to do this correctly, as we have no acceptable repair for this error, short of redoing the entire wing.

Dry Micro Fill - Bill Talutis suggests filling the T.E. depressions with gobbed up dry micro, cover with a peel ply strip, then using a putty knife at 45 degrees angle to smooth it down flat. The peel ply keeps the micro from building up and sticking to the knife. Remove peel ply after cure.

Elevator Trim Authority - some EZ owners have had insufficient high speed or low speed trim authority. If, after checking your trim spring rigging (CP 14 Page 5), you still require trim to fly hands off, install a trim tab on the elevator as shown. Bend the tab up for more up trim or down if you need more down trim. **SKETCHES OMITTED**

VARIEZE PLANS CHANGES - Incorporate these NOW

Section V Page 6	After "sand the surfaces lightly by hand" add "using 36-grit (featherfill requires a mechanical bond so do not use fine sand paper)" Add "do not wet sand featherfill, it absorbs moisture. Featherfill cannot be used over primer. 3M sanding screen type 18N FABRICUT WET OR DRY silicone carbide 180 works excellent on featherfill. It is available at lumber yards.
Section IIA & IIc 1st edition only	Install the gascolator, fire resistant fuel lines and valve as shown in this newsletter.

Owners Manual Page 31	Strike reference to bathroom scales. Add "align the scales or use grease plates to avoid side loading scales."
Newsletter 17 Page 5	Clarification - the wide chord elevator must be balanced to the same criteria as the original one. This may require additional lead weight. The additional weight should be added to both the inboard and outboard arms. This may require enlarging the slot in the canard at the outboard arm. Do not fly a new airplane without the wide chord elevators installed. Bruce Muirhead has flown his EZ with both the original and the wide chord elevator configurations. His comments "I flew my VariEze first with the original chord length and had the anticipated difficulty bobbing up and down on take-off and landing. After a couple rather hectic hours (and the realization that the elevator bottoms were not flat) I decided to extend the chord. The most important improvement I see is at take off. Now I can pretty well establish a good solid nose-off attitude at about 55 mph and hold it there while take-off speed is gained. Then the take off is positive and "up and away."
Section I Chap. 15	Add "Check to see if the seat belt brackets are radiused where the nylon belt loops through. Radius any sharp edges to avoid cuts in the strap"
Section I Page 12-3 CP 12, pg 7	Change toe-in angle to 1/4 to 1/2 degree. Excess toe-in causes excessive tire wear and increases the speed for nose rotation.
Owners Manual Page 17	Under "Tie Down" add "normal care of the main landing gear should always include lifting one wing tip to allow the gear to spring inward when parking, especially in hot weather. This reduces the possibility of gear creep and loss of alignment. Gear creep should not occur unless the airplane is overweight".
Section IIA	Change tygothane part numbers from 0505-107 to 0585-107

SHOPPING - Engines for sale: C85-8FJ call Pastor Jenkins (517) 626-2145. O-200 modified for 100 11, call Dave at (305) 425-2850

Wanted: Used epoxy pump - Ralph Freshour (213) 673-2819

Custom aircraft parts, 1318 Gertrude, San Diego, Ca 92110 is now making a muffler system similar to the flight research mufflers.

Aircraft Spruce's new catalog has been expanded to 230 pages, including 17 pages on composites (materials, tools etc).

OSHKOSH BULL SESSION RESULTS.
Stall Characteristics - all but two reported that stalls were as described in the owners manual. One noted that his would roll off after about three cycles of wing rock. One reported that at aft cg, his airplane would roll abruptly when he approached full aft stick and result in large altitude losses.

Trim change in rain - Based on the Bull session and on the test several owners made returning from Oshkosh, VariEze's all have a nose up trim change when in mist or light rain - this occurs even before the mist is seen on the wind shield. In moderate to heavy rain some VariEzes trim nose down.

Antennae Performance - while most have satisfactory reception, many have had poor results. The H & C antennas are working well with most of the lower cost radios, but the higher output units have had interference and some have had to mount the antennae farther from the radio, or use an external antennae. Nat Puffer reports good results using homebuilt antennas shown in EAA "Sport Aviation," October '76 issue.

UFO Reports - Three of the EZ's had been reported as UFO's in separate incidents.

Exhaust Systems - Two at Oshkosh had the mufflers, most had combinations of either straight stacks or the short double-bend tubes. Herb Sander's airplane had a system with flex joints and exits at the cowl T.E. near the prop tips. This simplified cowl removal. We asked Herb to keep us informed on how it held up after 100 hours since if it is durable we would like to get someone to produce it. How about it Herb? Let us know. By the way Herb's trip to Oshkosh from Memphis with his wife was the first time his airplane had flown two-place. His first flight was only seven days earlier.

Pitch Sensitivity - Nearly half the owners reported their airplanes were initially difficult to control in pitch until they got used to the sensitive forces. None at Oshkosh had the wide-chord elevator.

VARIEZE STALL CHARACTERISTICS AND FLIGHT TESTING
As discussed in the owners manual, "CP14, 15 & 17" not all VariEzes have the safe stall-proof characteristics intended. While the exact reasons for this are unknown, we have traced it primarily to cg position. For example, Lowell Ridge of Reno experienced a spin while doing stall tests on his first flight. He later found his weight and balance was incorrect and he was operating aft of the cg limit. He now reports standard stall characteristics at normal cg positions. Two EZs have reported bad stalls with large altitude loss, even at normal cg positions. As we have said before, a new homebuilt can be full of surprises in many ways: systems operation, flying qualities, performance, spin characteristics. This is to be expected from airplanes built individually without tooling and with a near infinite variety of things that can be slightly different.

The important thing that you must do as an individual is to realize that there is an enormous difference between flying a new untested homebuilt and flying a rented Cessna. You have the responsibility for conducting a safe test program and envelope expansion. Any time you expand the parameters (stalls, cg range, dive speed, load factor, gross weight, etc.) you should do it with a parachute and at least 8000 ft altitude AGL.

I have flown first flights on eight different canard homebuilt airplanes and have found the correct, docile stall characteristics on all of them. But, this does not mean that I would test the next one, opening the envelope of operation, without a parachute or without expecting to find something different. Never fly a new aircraft slow and low until you know its slow speed characteristics as tested at an altitude that allows a safe recovery.

ACCIDENTS There have been two fatal VariEze accidents since August. We presently have very little information on these, as FAA has yet to release its findings. The following information is listed here not to infer that we know the causes, but in the hopes that knowledge of the circumstances may in some way prevent reoccurrence. The first was one of the airplanes that was at Oshkosh. It had a total of about 60 hours flying time. It was sold to two people. One of the new owners had no problem flying it and made several flights without incident. The other partner had considerable difficulty flying the aircraft but landed safely. On his second flight he was observed to be flying erratically on takeoff and during climb. He apparently approached much too slow, as the airplane was observed in wing rock at about 50 ft. height (+ 45 degrees bank angle). The aircraft fell at a high sink rate from about ten feet height, possibly damaging a wing tip or rudder at initial impact. At initial impact, power was applied, presumably for a go-around. The aircraft bounced nose high and abruptly turned left, then rolled left, striking the ground in an inverted attitude.

The second accident occurred on the third flight of a new airplane. The pilot had noted on the first flights an inability to trim the airplane, having to push on the stick to hold it level. The owner had neglected to trim the canard length, even though the airplane was tail heavy. He had not installed the wide chord elevator and did not correct the elevator shape even though it was similar to the "dangerous" one shown on "Page 11 of CP 17. On his third flight he was observed to be lowering the nosegear on final about 400 feet altitude when the airplane pitched up abruptly and rolled until striking trees in a near vertical attitude.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

AD-1.

17 plys of UND & BID on a 32-ft wing takes 12 hours!

AOA indicator on Mike's Viggen. See page 13.

Viggen, EZ, Quickie, Defiant.

THIS PAGE IS FROM SECT IIA 2ND EDITION

FUEL SYSTEM

The fuel system consists of two wing tanks and a small fuselage tank, all equipped with visual sight gauges. A three-way selector is located on the pilot's right console. The selector is positioned left to select wing fuel, up to select fuselage fuel, and right to off.

The wings hold about twenty-four gallons total, all is usable for climb or level flight. One to two gallons per tank are not usable for steep descents. The fuselage tank holds about 2.8 gallons, all is usable in all normal attitudes.

Drains are provided at the wing tanks and at the gascolator. The wing tanks are vented together to maintain equal tank fuel levels. The fuselage tank has a separate vent to provide redundancy from a clogged vent. The fuel selector handle is designed to interfere with the pilot's wrist when the fuselage tank is selected, as a reminder to not takeoff on fuselage fuel. Fuselage fuel is only used as the last fuel on a long trip. This allows complete use of the wing fuel and a very accurate indication of the last 1/2 hour fuel supply.

Do not delete the fuselage tank. Without it, the unusable fuel for descents of about three gallons becomes just "dead weight." Thus, by adding the 2.5 gallons, you are adding about 5.5 gallons of usable fuel (over 150 miles range) and providing very accurate gauging of the last 2.5 gallons. Note that all the wing fuel can be used in level flight. It is not unusual to completely run the wings out during cruise, select fuselage to restart and continue, on fuselage fuel. See "Owner's Manual" (2nd edition) for operation of the fuel system. **SKETCHES OMITTED**

The schematic shown below shows the general arrangement of the entire fuel system. Details of each area are covered in other parts of this manual. **SKETCHES OMITTED**

CP18, Page 7

THIS PAGE IS FROM IIA SECOND EDITION

FUSELAGE TANK

Refer to "Section I," chapter 22, step 3. Do not install the urethane foam along the rear of the plexiglass. Cut the FT30 bulkhead from 9 mm, 6-lb PVC to fit as shown to the firewall. Attach it temporarily with a couple dabs of 5-MIN. Cut out FT31 from 9 mm PVC foam, heat-form it (in an oven at 300 degrees F or with a high-watt hair dryer or heat gun) to fit around the top between the plexiglass and the firewall. Trim as required. Mount it with micro to the plexiglass and with 5-MIN dabs to the firewall. Now, complete step 4 and 5 of chapter 22. When cutting off the canopy (page 22-4) change the 4" and 5 1/2" dimensions at the back to 5 1/2" and 8" respectively. Fabricate FT32 bulkhead and FT33 bottom pieces to fit as shown, leaving room at the bottom sides for the shoulder harness attach points and main wing vent tubes. These parts are not dimensioned. They have to be custom-fit due to variances in canopy size.

Cut the tank away from the fuselage, leaving the small side pieces in place. Bond the FT30 and FT32 to FT31 with wet micro holding in place to cure with nails. Place a strip of Vinyl tape or shiny-surface duct tape on the inside of FT32 where the visible fuel gauge is located. Layup one ply BID at 45 degrees on the entire inside and on the inside surface of FT33. This layup should be wet to avoid pin holes.

Mount the fuel outlet in the forward center of FT33. The outlet is a 6-inch length of 3/8-inch soft aluminum tube. Sand its surface dull for bonding. Mount it at an angle as shown to bond along about 2 inches of the tank inside bottom. Flow in a liberal amount of wet flox and cover with 1 ply BID. This gives the outlet extra durability so it will not break loose. Before bonding, form the outlet so it will eventually lie along the front face of the center-section spar and not interfere with the hole in the spar or shoulder harness attachment. The outlet should not be bent after it is cured, as this can induce cracks or leaks. Fabricate a screen and install as shown in "Section I," page 21-4.

Now, bond FT33 to the tank with flox. When cured, remove the foam from the face of FT32 over the vinyl tape and remove the tape. Be sure the outlet is open to relieve any pressure during cure. Round all edges of the tank and glass it with two plies BID, lapping 1" onto the existing glass on the outside surface of FT31. Use peel ply to transition the exposed edges. Be careful to get no traces of micro on the visible fuel gauge. The gauge gives a good visible indication only if it is not contaminated with micro foam or air.

When cured, test for leaks using an altimeter with 1500-ft pressure. Identify any leaks with soap bubbles applied with a brush. Rinse and repair per "CP" 14. Cut a 2-1/8" hole in the top using a hole saw. Clean out contamination with a vacuum cleaner (tape a 1-inch tube to the hose to reach in). Bond in the Brock VariEze fuel cap (FT18). Drill a #40 hole in the cap to provide a vent.

Mount the tank to the fuselage with a 1-ply BID strip all around its edges. This will allow it to be removed if later required. Drill a 1/2" hole in the aft seat bulkhead for the 3/8" ID x 1/16 wall Tygothane tubing.

SKETCHES OMITTED

THIS PAGE IS FROM IIA SECOND EDITION

FUEL VALVE INSTALLATION

Locate your Weatherhead #6749 valve. Remove its handle and disassemble the valve. Carefully remove any burrs in the valve ports that can scratch its Delrin plastic spool. Chuck the handle stem in your drill and using emery paper remove enough of its diameter so it will slip inside the valve torque tube. When about .007" is removed it will slip inside the 3/8 x .035 2024T3 tube. Reassemble valve.

Cut the alum tube to 68.5 inches long. Mount the tube to the valve with two #8-32 screws as shown. Fabricate the FV1 plywood piece and bolt it to the valve with two AN4-6A bolts.

Fabricate the FV2 plywood piece and mount to the right forward armrest as shown in the upper right of page 19-5 of "Section I" (2nd edition). Fabricate the handle and drill it into the tube, clocking so it will be outboard for "off," up for "fuselage" and inboard for "wings." Do not mount it until final installation.

Now, grab the tube/valve/FV1 assembly and thread it into the fuselage passing through the CS118 hole in the backseat area and through FV2. The tube will have a gentle bend and should not bind on the seat bulkheads. When you are satisfied it fits well and clears all controls, bond FV1 to the fuselage side and let cure. Then remove the two AN4-6A bolts, remove the valve and layup 1 ply BID on each side of FV1 lapping onto the fuselage side.

Round up the plumbing parts shown and install them on the three valve ports using Teflon tape. Install the Tygothane tubing with the hardware shown. Do not substitute vinyl, polyethylene, polypropylene or Tygon tubing. They are not near as tough, are not fuel compatible, and get brittle at low temperatures. Tygothane has a tensile strength of 5900 psi and avoids brittleness down to -100 degrees F. Mount the gascolator on the firewall and plumb the aluminum line as shown (pg 17). An alternate (better) method is to use the gascolator installation bracket shown on page 100 of the 1978 Aircraft Spruce Catalog which mounts the gascolator with one port facing the firewall to allow direct routing of the fuel line through the firewall.

SKETCHES OMITTED

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THIS PAGE IS FROM IIA SECOND EDITION

SKETCHES OF VARIEZE FUEL SYSTEM OMITTED

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EXHAUST SYSTEM

The preferred exhaust system for the VariEze is the system consisting of two mufflers, one on each side, directly below the exhaust ports. This is similar to the system on Cessna 150's. The mufflers reduce the noise level and provide excellent heat for carb heat and cabin heat.

Use Continental exhaust gaskets (part no. 21493) on final installation. For initial fit-up purposes, don't use your gaskets. The initial "set" taken by the gaskets when the flange is torqued down provides a custom seal for that exhaust pipe and several cycles of installation and removal reduces the effectiveness and life of the gasket. Use 5/16 x 24 brass exhaust manifold nuts with AN960-516 washers (8 ea) for final installation. Be sure to install the support on the right muffler.

The mufflers require a homebuilder-fabricated blister to fair them in to the cowling. This job is not as difficult as it appears. When

fitting the cowl, cut a hole to clear the mufflers by 1/2-inch all around, plus clearance to hookup the heat muff hose. Put the mufflers and cowl on. Using some soft wire (coat hangers) make three or four "templates" to define the shape of the blister to clear the mufflers by about 1/2 inch all around. Remove cowl and place on a table upside down. Tack a large block of foam (green or blue) on the cowl and carve to a pleasing shape that clears the mufflers. Line the edges with gray tape to provide a release then glass with four plies BID. Remove the blister, and dig out the foam. Sand the cowl surface and attach the blister with flox and pop rivets with 3-inch spacing. Leave about 1/4" space around the muffler outlet pipe so the excess muffler heat can escape.

You will be surprised at how little cabin heat is required for a VariEze. In general, the natural solar collection of the canopy and insulation of the cockpit will provide sufficient heat for day/VFR flying, as long as the canopy is well sealed. N4EZ's cockpit temperature can be maintained at 65 degrees f with an OAT of 25 degrees f. In the summer heat, the cockpit is well cooled by opening the vent.

We recommend that you do not install cabin heat, to save weight & complexity. If your flying experience indicates you need it, it is easily added later by adding a tee in the carb heat hose and plumbing a 2" dia (1 1/2 may be enough) hose to the feet area of both cockpits. Install an adjustable valve in the line to control the amount of heat.

SKETCHES OMITTED

THIS PAGE IS FROM IIA SECOND EDITION

A less expensive, lighter, and louder system can be made as shown with three straight stacks and one double elbow. The double elbow is used on the left forward cylinder to provide sufficient pipe length for a carburetor heat muff. The heat muff consists of a over-stretched screen door spring wrapped around the pipe to transfer heat and a sheet metal shroud wrapped around the area to collect heat. Note that this pipe must be supported to the cylinder by the tube shown, to prevent vibration failure. The three straight stacks are equipped with safety cables to retain them, should they fail at the flange. This keeps them out of the prop. Do not omit this!

Various other exhaust systems are presently being developed and tested. As they prove successful they will be defined in the "Canard Pusher" newsletter.

SKETCHES OMITTED

THIS PAGE IS FROM IIA SECOND EDITION

HEAT MUFF

Cold air enters at the ends and at the right side and is warmed by the hot pipe and hot spring, before being drawn off at the 2 1/2" tube at left center. **SKETCHES OMITTED**

To fabricate the spring, take a 1/2" dia screen door spring and over-stretch it so the gaps in the wire open to about 1/10". Attach it to one of the tabs with 3 loops of .041" dia stainless safety wire. Wind it tightly around the tube and attach to the other tab.

The muff shroud can be built by forming a flat sheet of .025 6061T6 alum to fit over the spring wrap as shown. Cut the outlet hole and weld on a 3-inch length of 2 1/2" dia 6061-T6 tube. Fasten as shown with three #8-32 screws and locknuts.

Support - This tube must be supported to prevent vibration-induced failures. **SKETCH OMITTED**

The support can be a 1/2 x .035 steel tube. Heat the ends red-hot and flatten. Bolt to the welded tab on exhaust tube and bolt to a valve cover bolt on the engine.

Install a 2-1/2 diameter SCAT-10 (RED) induction hose from the air valve to the muff. Follow the clamping details shown on page 17. This hose should be retained against the engine mount with a nylon "tie wrap". So that it doesn't chafe against the cowling.

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ANGLE OF ATTACK VANE AND SWITCHING GEAR.

The pivot is made up of a 1 1/4" length of 5/8" - .062 aluminum tube, with an MRC R 3ZZ bearing (or equivalent) pressed into each end. The spindle is a .187 dia. stainless steel rod, 1 3/4 long. This is pressed into both bearings as per drawing. If it or the bearings are loose, use Loctite to be sure the spindle and bearings are firmly located, but free to spin. An aluminum vane is attached per drawings to the outboard end of the spindle. This vane can be carved from solid aluminum, or fabricated. An aluminum arm is cut from 3/16 stock with a balance weight as shown. Install the vane and balance arm on the spindle and balance them by grinding the balance weight down. The brass brushes are cut from .005" brass shim stock. These are split back from the contact end to the mounting area, as shown in the enlarged detail (no scale). The switching board is a piece of copper clad circuit board, obtainable from Radio Shack. Lay it out as shown. The detail is full size, and may be scaled. Remove all the copper cladding except in the areas shown. Drill three small holes where indicated, and push #22 wires through from the back side and solder to each copper area. These wires go to the light bulbs in the three light A.O.A. indicator, mounted on top of the glare shield or high in the panel. The circuit board is epoxied to a piece of 3/8" thick phenolic. A 5/8" hole is drilled through the circuit board and phenolic block. A #10-32 set screw is installed as shown to lock the circuit board and phenolic block to the 5/8" spindle housing, and to serve as a ground wire attach point. A similar phenolic block is epoxied to the inside of the nose cone. A 5/8" hole is drilled through the phenolic and the nose cone skin. A #10-32 set screw is installed in this block, is used to fine tune the A.O.A. vane.

When flying the A.O.A. indicator, only the green light should be on when the airplane is "on speed" on the approach. If you increase the airspeed by about three knots indicated, you will have the green and yellow (lower) lights on. Further increasing the airspeed by three knots will leave only the yellow light on. Slowing the airplane down three knots (increasing angle of attack) from a green light (on speed) will switch green and red (top) lights on. Reducing speed three more knots leaves only the red light on, indicating too high of an angle of attack (too slow). This is a simple yet very effective way to achieve consistently good landings. The A.O.A. indicator is wired through the gear down and locked, and therefore is an excellent gear up warning.

For first flight in a VariViggen, set the vane at 11 degrees - 12 degrees up with the bottom of the airplane level. The vane pivot must be set at F.S. 9" and W.L. 12". Then adjust as req'd to obtain the correct speeds.

SKETCHES OMITTED

CP18, Page 13

BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft stick	49 mph
	Landing	500 ft
Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 square ft
	Wing Span/Area	19 ft/119 square ft
	Empty Weight	950 lb
	Gross Weight	1700 lb
Performance with 150-hp. Special Performance Wings Specifications	Climb	1000 fpm
	Cruise	158 mph
	Wing Span/Area	23.7 ft/125 square ft
Special Performance Wing	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm roll over 50 degrees per second without rudder co-

ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73 and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY.
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips". Gas service and other airport services have been better too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS.
AIRCRAFT SPRUCE & SPECIALTY CO, 201 W. Truslow, Box 424, Fullerton, Ca 92632 (714) 870-7551
VariViggen spruce kit, plywood kit, hardware, aluminum and fiberglass. Catalog cost $3

KEN BROCK MFG. 11852 Western Ave, Stanton, Ca 90680 (714) 898-4366
VariViggen prefabricated components: all machined parts. Catalog costs $2

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave, Dayton, Ohio 45424
VariViggen plexiglass canopy. (513) 845 9872

MONNETT EXPERIMENTAL AIRCRAFT, INC., 955 Grace St, Elgin, Il 60120 (312) 741-2223
VariViggen molded fiberglass parts.

GOUGEON BROTHERS, 706 Martin, Bay City Mi 48706
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS, 4102 Twining, Riverside, Ca 92509
VariViggen welded nose & main landing gear, 1-1/4" sq. steel tube.

JESSE WRIGHT (VariViggen builder) 7221 S. Colorado Ct. Littleton, CO 80122 (303) 771-5140
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price - $10.00 first class mail, $11.50 Air mail- overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price - $6.00 first class mail, $7.50 Air mail- overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, and flight reports as possible. Details mandatory, desirable, and optional changes to plans and to owners manual. A newsletter subscription and back issues starting with CP#19 are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price - $4.75 per year first class mail, $6.50 air mail overseas. Back issues, $1.00 ea.

VARIVIGGEN PLANS - SECOND EDITION. This is an updated, revised set of very complete drawings and construction manual consisting of a bound 11" x 17" book, containing many photographs, hints and instructions based on actual builders experience over the past several years. It covers the entire airplane, including the engine installation, fuel system, and not only covers the original standard wing in both aluminum and foam and fiberglass composite, but it also includes the composite S.P. Wing, ailerons, and rudders. The manual identifies sources for all required materials and all available prefabricated parts and components. Price - $165.00 first class mail, $177.00 Airmail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18% - size radio-controlled model airplane built and flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment and engine in the .35 to .65-cu inch size. 555-sq inch wing area.

All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price - $4.75 first class mail, $5.50 air mail overseas.

VariEze

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $2600 (less engine) in about 1000 man-hours, or from prefab parts and materials, costing approximately $4000 in about 600 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability,

dramatic reduction in hardware and number of parts, easier to inspect and repair. The VariEze uses the small four-cylinder Continental aircraft engines. The 0-235 Lycoming, stripped of starter and alternator, is now being tested and should be available soon. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 20 gallons of fuel. Frontseat passengers up to 6', 7"/250 lbs and backseat passengers up to 6', 5"/220 lbs can be accommodated plus a modest amount of baggage in two custom suitcases. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (60 kt/70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE TEST PROGRAM The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE HOMEBUILDER SUPPORT The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$139.00	$153.00
Section IIA	$19.00	$21.00
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Section III	$8.00	$9.50
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Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95

Add 6% if Calif resident - newsletter is not taxable.
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TOTAL

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

SECTION IIA - Continental A65, A75, C85, C90, 0-200

SECTION IIC - LYCOMING 0235 - No accessories.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS & PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP @ GROSS WEIGHT:

Take Off	900 ft
Climb	1600 fpm

Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	560 lb
Gross Weight	1050 lb
Range @ Max Cruise	700 mi
Range @ Econ Cruise	850 mi
Min Speed (full aft stick)	55 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6 square ft
Canard Span/Area	12.5'/13 square ft

SPECS & PERFORMANCE WITH 75-HP CONTINENTAL:

Take Off	1050 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	530 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

AIRCRAFT SPRUCE & SPECIALTY CO. or WICKS AIRCRAFT SUPPLY
201 W. Truslow Ave, Bx 424 410 Pine
Fullerton, Ca. 92632 . Highland, Il. 62249
(714) 870-7551 (618) 654-7447

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680 (714) 898-4366: Prefabricated components - wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, 6 Mojave Airport, Mojave, Ca 93501, (805) 824-4558: Prefabricated components - cowling, fuel tanks, wheel pants, maingear & nosegear struts, strut cover & nosegear box. Send SASE with 3-oz postage for brochure.

THE AIRPLANE FACTORY, 7111A Brandtvista, Dayton, Oh 45424 (513) 845-9872 or 233-7754 - Canopy.

H.C. COMMUNICATIONS, Bx 2047, Canoga Park, Ca 91306, (213) 882-0422. Custom COM & NAV VHF antennas.

Defiant photo by Don Dwiggins. **PHOTO OMITTED**

THE CANARD PUSHER NO. 19 JAN 79

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If you are building a VariViggen from 1st edition plans you must have newsletter 1 through 19. If you are building a VariEze from the second edition plans you must have newsletters 16 through 19. A current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any part for our comments. We are normally open from 9:00 to 12:00 and 2:00 to 5:00 on Wednesday through Saturday. If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions." This will speed our reply.

RAF ACTIVITY since the July Newsletter has involved some new developments in support of VariEze builders. We are now introducing two important new improvements for the VariEze - a wing leading edge cuff to improve stall margin, and a crank-type nose gear actuator.

Approximately 25 new VariEzes have taken to the air since the last newsletter. Our prototype, N4EZ now has 400 flight hours.

Our Defiant, VariViggen, and VariEze have all been flown extensively lately, logging about 150 flight hours since October.

The NASA skew-wing AD-1 successfully completed its static load tests. It will be delivered to Edwards Air Force Base next month for research flight tests. This is the first non-homebuilt aircraft to use the structural methods developed for the VariEze. Ames Industrial Corp. should be congratulated for building the AD-1 "on-cost" and "on-schedule". This is rarely accomplished by the large aircraft companies.

THE COMPOSITE WORK SHOP held at RAF on 23rd November, was attended by over 350 people! In addition to the fiberglass education, an airshow was given. It included a Quickie flight demo and a three-ship

formation with the Defiant, VariViggen, and VariEze. We hope to make the workshop an annual event.

THE QUICKIE PROTOTYPE now has 250-hr flight time. Tom and Gene report an operating cost of $3.25-per-hour for the last 14 months, including fuel, oil, maintenance and insurance. Quickie has orders for 185 kits and has delivered 125. About six homebuilt Quickies are nearing completion. Quickie Aircraft Co. plans a seminar tour this spring, flying N77Q to several cities. Details on this will be in the April Quickie newsletter. For the newsletter or any details on Quickie, contact them at Quickie, Bldg. 68, Mojave Airport, Mojave, Ca. 93501 (805) 824-4313.

PHOTO OF VARIVIGGEN, VARIEZE, QUICKIE AND DEFIANT OMITTED

Bob Hoover, after his flight in the Quickie. Bob also flew the Defiant last October during the Mojave Air Races. **PHOTO OMITTED**

THE SECOND EDITION OF THE VARIVIGGEN PLANS has finally been completed. Our apologies to those who were told it would be available in November. It was just a much larger job than we estimated. Mike has been working over three months on this package now. It includes all the information previously included in the 1st edition plus the two construction manuals, the S.P. wing plans, a new composite "standard" wing section, additional construction hints, the Melvill-designed worm drive main gear and our "Moldless Composite Aircraft Construction" book. Of course all improvements incorporated since the beginning have been included. The second edition VariViggen plans are more than double the number of pages of the 1st edition. Many of the parts are now shown as full-size patterns. We expect the 2nd edition from our printer by mid February.

DEFIANT FILM - Ferde Groffe Films is now finishing a new sound movie on the Defiant. Flying for this film was done in December. We understand it is even more spectacular than their Award-winning "Flying is VariEze" film produced in 1977. The new film shows the Defiant being put through its paces including loops, rolls, single engine takeoffs and an exciting comparison of it and a Beech Baron. Ferde is well known for his artistic blending of film and music. The new Defiant film is available from Ferde Groffe Films, 18139 Coastline Drive, Malibu, Ca 90265 (213-454-3886). Write them for purchase or lease terms. It is available in 16 mm and super 8. Prices are similar to the VariEze film.

DID YOU KNOW that a 100 hp. VariEze can climb over 25000 ft. without turbocharging? Dick Rutan flew N4EZ to 25,300 ft on November 30, 1978. At 25,000 ft it trued out at 125 mph at 2100 rpm and 11-in manifold pressure. At 20,000 ft, maximum speed was 148 mph. Temperature of the cockpit remained 40 degrees above outside, despite the absence of a cockpit heat system. Takeoff gross weight was 890 lb. including 12 gallons fuel and 15 cu.ft. of oxygen. The structure remained below minus 30 degrees C temperature for half-hour. There were no indications of structural deterioration.

On November 7, '78, our Defiant light-twin prototype made a flight to determine its maximum endurance. The airplane was topped off with its normal load of 90.5 gallons and flown solo by Dick Rutan. He took off at 8:47 a.m. and landed at 23 minutes after midnight - a total flight time of 15 hours and 36 minutes! The Defiant's accurate fuel gage system allowed Dick to land with confidence, with only 2.5 gallons of fuel remaining. Both engines were run for the entire flight. The average fuel flow was 2.8 gallons per-hour per-engine, approximately 20% power, 1700 rpm and 13 inches manifold pressure. Mixtures were set at peak EGT. Speed ranged from 86 kt indicated at the start to 80 kt when low on fuel (maximum endurance speed). Distance traveled was nearly 1400 nm (1610 statute miles). Oil used was 1.1 qt-per-engine. Note that this data was obtained with fixed-pitch props whose efficiency is poor at low speeds. Maximum range at best range speed is about 1480 nm (1700 statue miles), with a light payload. This efficiency is a direct result of the canard arrangement with winglets - giving very low induced drag.

We have service-tested the Defiant prototype extensively and found that it can indeed provide utility not found in conventional aircraft. Examples: Los Angeles to Norfolk Va. with one stop in Dallas, cruising at 17,500 ft. Upon arriving at Norfolk we made two practice instrument approaches, landed, flew a 30 minute demo flight loaded with NASA personnel and then fueled the aircraft - 45 minutes of fuel remained! More significant was a trip from El Paso to Los Angeles with 600 lb cabin load, into 45 kt to 65 kt headwinds, in cloud and rain for 2 hours and had to climb to above 14,000 ft to shed rime ice. Airports enroute were below IFR minimums. A conventional light twin could not have made that trip. The Defiant landed in Los Angeles with two hours fuel!

WING CUFF IMPROVES VARIEZE STALLS - As you know from newsletters # 14, 15 and 18, not all the VariEzes flying have reported the safe, departure-free stall characteristics. Several aircraft have reported highly divergent wing rock or an abrupt roll-off into a nose down rolling dive resulting in a large altitude loss, when near full aft stick at aft cg. In late November, Dick was demonstrating stalls, with David Record in the back seat of N4EZ. After showing the stall resistance by level and turning stalls at full aft stick, including sideslips and reversals, Dick let David do some stalls from the back seat. In one of David's stalls, the airplane abruptly rolled left and appeared to spin one and half-turn before recovering, with a loss of 1200 ft altitude. This, of course was quite a shock, since we had never experienced a departure from controlled flight with our VariEze. A post-flight weighing revealed that the cg was within a half-inch of the aft cg limit.

We then initiated a complete series of new stall/spin tests with N4EZ to try and further quantify its stall resistance. The airplane was ballasted to various cg positions and tufted to visualize airflow. Dick flew the test flights. A summary of the results follows:

The aircraft was totally immune from stall departures or loss-of-control regardless of control inputs or attitudes or power setting as long as the cg was forward of F.S. 101 (short canard, 142 inch span). The following applies to its characteristics when the cg was aft of F.S.101: The aircraft was immune from loss-of-control or departure

when maneuvered, ie, attempting accelerated stalls. It was also immune during low-energy entries, ie, hammerhead stalls or tailslides. However, occasionally the characteristic wing-rocking motion would diverge and result in a departure to the left within about four cycles of wing rock, at one - g flight. Also, occasionally the airplane would depart in roll to the left without wing rock if the speed was about 48 knots (one-g, level or mild nose-up climb). The departure at first appeared to be entry into a steep spin, since rotations up to one and half "turns" were experienced. Recovery was prompt, as the the stick was pushed forward. We soon realized that the departures were not spins, as the angle-of-attack was rapidly decreasing and the motion was quickly converted into roll, i.e. there was no stable spin mode. To prove this, full pro-spin controls were held in (aft stick, left rudder), rather than attempting recovery. With these controls held in, the airplane's recovery was just as rapid as when recovery controls were used. Thus, rather than a spin, the aircraft was experiencing a "rolling departure". In military stall testing with fighters, we called these maneuvers "recovery rolls" or "augers".

The good news is, of course, that stable spins were not possible. The bad news is that the aircraft is susceptible to departures with altitude loss as great as 2000 ft when near aft-limit cg. It would be easy to merely brush this off as "normal" and stress the usual training lesson of speed control to avoid stall. We refuse to do this, because we have always been proud of the departure-resistance of a properly-designed canard airplane. Thus, with the help of NASA at Langley Va. we developed a solution. Joe Chambers at NASA had been conducting dynamic wind-tunnel tests with a model of the VariEze. He found that a partial-span drooped "cuff" that extends forward of the leading edge produced a vortex that prevented aft wing stall and eliminated wing rock on the model.

We then did more tests with tufts to verify that, indeed, the departure is caused by aft wing stall. We then installed the cuff - initially 50 inches long, and found that it eliminated departures but did not eliminate wing rock. We then trimmed it to 38 inches long, and found, as NASA predicted, it completely eliminated wing rock and departures. Wing rock induced with the ailerons would damp out after being excited.

At aft limit cg the airplane is as safe as at forward cg. The vortex formed by the sharp edge of the cuff results in the stall angle-of-attack being raised by more than can be expected by the increased droop of the leading edge.

If you have difficulty understanding the above technical discussion, that's ok. Your airplane may already be stall resistant at the aft cg limit in general. However, flight tests and homebuilder experience indicates that it is possible that at aft cg positions, certain conditions could exist where it may be possible to stall the aft wing. A stable spin will not result, but the airplane can roll off to one side and lose considerable altitude.

The end result is that when you install the simple extension to your wing leading edges your airplane should be totally stall resistant at any allowed cg position.

Based on the results of these tests we recommend that you limit your aft cg to forward of F.S. 100.5 for short canard and 99.5 for long canard (see page 27 of your owners manual), until you have installed the leading edge cuffs. Install them exactly as shown on page 6 of this newsletter. Do not modify their shape or round their ends. If you are now building a VariEze, the cuffs can be installed any time after chapter 6. Do not change anything in chapter 6.

The cuffs have been dive tested to 215 knots to verify freedom from flutter. Data also indicate that they provide a small improvement in stability, max speed is degraded slightly - about two knots. Climb and cruise range are not changed.

Do not omit this improvement - do take advantage of the extra work we are doing to provide you with the safest possible airplane.

NEW SYSTEM SOLVES NOSEGEAR COLLAPSE - As reported in the "Canard Pusher", several EZ flyers have had their nosegear come out of the lock during taxi or landing. We had traced these to interferences which prevented full NE11 engagement, or improper rigging and snub of NE10, or to incorrect pilot actuation of the system (pushing downward, rather than forward on the knob, bending NG10). However, even though all these items have been covered in the newsletter we still find that many are still experiencing collapse. Damage is generally minimal, but in three instances it has resulted in closing an active runway and the required filing of an FAA incident report.

Being finally convinced that this would continue to be a problem, we have developed and tested a new retraction system. NG11, NG12 and NG13 parts are now obsolete and no longer available from Brock. The new system is being fabricated by Brock. The new system can be easily installed even in a completed airplane. It involves removing the bolts in the NG13 guides, removing NG11 and NG10, installing a worm-drive system in the same bolt holes previously used for NG13's. The long NG10 tube is cut down to a short pushrod. The worm is actuated by a 3/8" x .035 aluminum tube extending to a crank on the instrument panel. This gives the pilot a lot more leg room, particularly with the gear up. You will now have room for two small engine instruments in the center console. Also, the possibility of injury in a crash with the gear up, is probably reduced. For these reasons you should retrofit your completed EZ to the new system, even if you already have the old system installed.

VARIEZE EXHAUST SYSTEMS - As you probably know, Ken Brock manufactured VariEze exhaust systems early in our program. His production was halted when it was discovered that that design was cracking due to vibration - induced fatigue, even though our prototype flew approximately 100 hours with this system without problems. Since then, at least ten different configurations have been tested. Some successfully, some failed, and some do not yet have sufficient flight time to judge as successful. The two most reliable so far are shown in the second edition of Section IIA and in CP #18. Most EZ's are using one of these systems. A few EZ's are now flying with a cross-over system that results in rather large, blunt bumps on the lower cowl. As far as we know these are holding up, but the separated airflow on the

bumps more than defeats the extra power in drag, and causes high propeller noise. We do not have very much information on this system, as to the number of flight hours etc. We are also interested in learning the operational experience of the other systems now flying. For example, the one at Oshkosh that exited at the cowl T.E. split line. As soon as we can identify an additional system that: (1) is quieter than straight stacks, (2) provides at least 90 degrees F carb heat temperature rise, (3) fits the airplane without excessive drag, (4) can be produced at low cost, (5) weighs less than eight lb., and (6) has been flight tested at least 125 hours without any indication of failure, then we will arrange for it to be produced by Brock for sale to homebuilders. In the mean time we will continue to recommend either the noisy straight stacks or the expensive mufflers. The Flight Research mufflers have been on N4EZ for 17 months and 155 flight hours. They result in a five mph. penalty but are quiet and have had no indication of cracks or degradation.

Please send us any operational experience data you have available on the system you are flying. Describe the system and engine type, any failures or degradation, temperature rise of carb heat system, and number of flight hours.

ACCIDENTS. VariEze takes on Cessna 172 at the Cable Airshow, 9 January 1979 - - both lost. Gerald Gardner's VariEze was on take off roll and at rotation speed a Cessna 172 pulled out for take off right in front of him. The VariEze rotated abruptly to try to fly over him and almost made it. The EZ's left lower winglet struck the 172's right wing in the flap area, followed by the left main gear hitting the right wing tip of the 172.

The EZ struck the ground beyond the 172 in a right turn. The canard tip and nose gear hit first, folding the nose gear back.

The canard came off the airplane removing part of F22 bulkhead. The canard and elevators including lift tabs were undamaged. The left lower winglet was damaged. The wing attach fittings were not damaged. The main gear folded back, failing three glass tabs and pulling one aluminum extrusion from the fuselage. The main gear strut was not failed. The right wing trailing edge split open from the aileron to the trim tab. The right winglet failed at midspan. The Cessna's right wing was totaled. There were no injuries. Gerald had 118 hours on his EZ at the time of accident. He said he loves his galactic wonder and will rebuild it.

CAUTION - FLUTTER As you should know, control surfaces must be balanced to the proper criteria or flutter is possible. Flutter is a very dangerous thing that usually results in inflight catastrophic structural failure. In the past we have cautioned you to observe balance criteria because we thought it might flutter if unbalanced. Now we know it will. One EZ owner bought a new VariEze from a builder and took his word that all was in order. It had retrofitted wide chord elevators and an elevator trim tab. The builder had failed to rebalance the surfaces, even though he had been reminded to in the last newsletter. The new owner experienced violent flutter while flying at a moderate cruise speed. Luckily, he was able to stop it by forcing the stick aft and reducing power. There was no damage. After the flight he removed the elevators and found they balanced more than 30

degrees nose up, way out of the 10 to 20 degrees nose-heavy requirement. Had the operator followed the owners manual procedure he would have found this before flight. He is very fortunate to be alive.

Many builders have overweight elevators, and then have added the extension, finding that they need excessive balance weight. We have not flight flutter tested an excessively heavy elevator and do not plan to do so. We therefore cannot tell you whether a balanced excessively heavy elevator is safe. It may not be safe. The elevators are a very small part of your airplane, but are the most important and most critical part. Do not accept less than perfection on your elevators. They must be light so that excessive balance is not required. They must be shaped exactly to fit the templates of Newsletter 17, page 11. The adjacent photo shows a wide chord elevator built at RAF this month. It balances 17 degrees nose down without paint and

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will balance at about 13 degrees with paint. The balance weights are positioned exactly as shown on the plans. No excess weight is required. They weigh 3.3 and 3.6 lb, with weights, ready for paint. If your elevators are overweight or are shaped wrong, strip them down to the bare aluminum tube and rebuild them. That extra work is the most important work you can do on your aircraft. Do not add more than 0.3 lb balance, to correct an overweight elevator. **PHOTO OMITTED**

VARIEZE BUILDING HINTS.
Cold weather operation hints from Nat Puffer, who has been operating his EZ in 15 degrees F (-26 degrees C) weather. "Direct a hair dryer into the air inlet for one hour before starting engine. 220 degrees F CHT and 120 degrees oil temperature resulted even when the oil tank insulator was used. I closed off half of the airscoop area and now can operate ok with 400 degrees CHT and 145 degrees oil. I must run continuous carb heat for smooth operation."

Also from Nat "modifications that add metal or tools carried in the thigh-support compartment can ruin the normally good performance of COM and NAV antennas."

John Foy, "After being unable to solve my high CHT, I calibrated the probe. At 200 degrees it was within 5 degrees. At 450 degrees it read 520 degrees! To calibrate I used a can of motor oil, heated with a propane torch. Immerse the probe and measure temp with a candy cooking thermometer. The gage was replaced and it now reads ok." More from John "Flight characteristics of our aircraft were not correct. We required a lot of nose up trim at all speeds. The faster we went, the more nose up trim was needed. Also at 20 mph before the stall the nose would come up to the point where nose down elevator would have to be applied. I believe that it was due to the strong nose up trim that was required for level flight. As the speed dropped off, the trim spring authority became the dominant factor. At the stall, back pressure was needed to keep it there and the nose would oscillate up and down, very slowly while the aircraft descended. The aircraft stalled straight ahead with no tendency to fall off on a wing. After talking with you I decided something had to be done to bring the aircraft to normal flight characteristics. We were convinced that our weighing was correct. In

your drawings you call for a minimum elevator to canard gap of .1 inches ours was .3 inches. I decided it was too large, so I closed the gap in the full T.E. up elevator position (20 degrees). Now our VariEze responds correctly." **SKETCH OMITTED**

The following sketch shows the preferred installation of the Aircraft Spruce oil separator. If you still have some oil on the cowl, cut a hole in the separator and stuff it with two "tuffy" plastic cleaning pads, (grocery store). Patch the hole with a plate of .032 aluminum pop-riveted in place and sealed with ProSeal sealant. This eliminated oil loss on N4EZ even during steep climbs, stall/spin and aerobatics. **SKETCH OMITTED**

Jim Ball reports his breather works better when tapped into the top of the starter cover plate, with an internal baffle to deflect gear train-slung oil. He plugs the normal breather.

Lee Herron contributed the following simple low-cost cabin heater. It uses a push pull control at the rollover back to a butterfly valve (made from scrap stainless) at the firewall. A two inch hose runs to a tee in the carb heat line. The heat is merely dumped in the baggage compartment. It flows around passengers' vented-type seat cushion (or it could come through holes in the seat back and forward through the rear armrests). Heat then goes over rollover (defrosting canopy), down around pilot's legs and exits around openings around nose gear. Canopy and main gear must be well sealed. Lee claims it works excellently. **SKETCH OMITTED**

CP19, Page 4

Do not peel ply entire structure. This starves epoxy from lower foam surface, makes inspection difficult, gives an erroneous impression of good surface smoothness, makes it easy to unknowingly damage structure during finishing and adds weight. Do peel ply surface edges of glass plies whenever they exist and, of course, whenever a lay up will be later made over a cured surface.

When fitting baffles, be sure to put cowling halves on one at a time, to carefully check for leaks. Metal must be within 3/4" of cowl to prevent rubber seal blow-by. A small rib on the left side attached to the cowl at the trailing edge is usually needed to seal air leakage.

Rosenhan wheels have sharp edges outside rims at three places. Round these to avoid cutting tires. Use only four-ply tires and inflate to 65 psi.

Jim Heitkotter 7327 N. Peach, Clovis Ca 93612, has offered to fly local EZ builders in his EZ to check them out before their first flight. It is a good idea to get an experienced EZ pilot to do your initial testing. Do get some EZ back seat time, if possible.

VARIEZE PLANS CHANGES.

Owners Manual
Bottom of page 34 add "are you sure you have complied with all details in appendix I?"

Section V	add "Dupont 100s can be substituted for 70s primer"
Section I page 17-5	AN4-7A should be AN4-10A (4 places). Also add "delete NG10, NG11, NG12, and NG13. Install worm gear retraction system shown in Newsletter 19"
Section I page 2-2	Revise the parts list to reflect the new nose gear system. AN4-7A (12) should be (8) AN4-10A (4) should be (8) RE4M6 (1) should be (2) AN316-6 (1) should be (2) AN3-10A (8) should be (9)
Section I page 2-1	Delete NG10, NG11 and NG13 Add, worm drive assembly - complete or individual components
Section IIA page 2 2nd Edition	0505-165 should be 0585-165 0716-202 should be 0716-020 "polyurethane" should be "nylon" (2 places). Add 3/8 x .035 2024T3 tube 70" long. 5/16 x .035 4130 tube 4" long.
Owners Manual page 27	Change aft limit cg to FS100.5 (short canard) and FS99.5 (long canard). These restrictions can be lifted after cuffs have been installed and flight tested.
Section IIA page 4	Oil Pressure gage listed as 287 AM or 287A8 should be 298A8 or 2A8. Delete 103-18 adapter.
Section I Chapter 6	add "see CP #19 for addition of stall cuffs on wing leading edges."

QUESTIONS

Q. I'm looking for a parachute for my flight testing what do you suggest?

A. We use a "security," it's only 16 lb and allows a 6'4" pilot to fit the EZ. There are other thin-line type chutes available. Check with the local soaring community. Sailplane pilots nearly always wear a chute and will generally loan you one for your testing.

Q. I have traces of black material coming from my epoxy pump, what now?

A. This is aluminum from the pump cylinder and is not a problem.

Q. My speed brake retracts at 90 mph even though the springs are tight.
A. Reduce the off-center distance of the stop for the rod end at the pushrod. It should be stopped at about 1/2" from a straight line drawn between the two pivots.

Q. My resin and hardener appears to have some settling in the bottles. Should I use it?
A. No, heat a jug of water to about 190 deg. Float the bottles in this jug for 1 hr to warm the resin. Shake the resin bottles. Then keep them stored at room temp. The settling should not reoccur.

Q. I want my EZ to look more like a Defiant. Can I eliminate the lower winglet?
A. Performance-wise, yes, it only gives about 1% induced drag reduction. But do not leave it off - it protects the rudder and cable in case you drag a wingtip on takeoff on landing.

DISTRIBUTORS

FRED JIRAN - recent reduced availability of components is now resolved. Normal 8-week delivery of landing gear is actually much shorter. Fuel tank orders received by 28 Feb. will be shipped by 31 Mar.

THE AIRPLANE FACTORY, Dayton, now offers 1/2 price replacement for canopy breakage within 3 years.

NEW PROP - Proton Manuf. Co., 5595 W. Colorado Pl., Lakewood Co., 80226, (303) 936-1683, makes a VariEze prop for the 0-200. Our evaluation shows it to be well built and has good takeoff, climb, and noise level. Maximum speed is about 5 kt slower than the Ted Hendrickson prop.

FOR SALE VariEze N1WX Dragon, by Lee Herron - Designers' Award, Oshkosh 77. See "Sport Aviation," Oct 77 and "Air Progress, Apr 78. 200 Hr TT. Pants, solar cells, mufflers, all mods. Box 357-WOB, West Orange, NJ. 07052 (201) 736-9092 Lee and Dianne are now building a Quickie.

A75-8 TT 1157 hr, T.S.O. 268 hr, all logs (206) 455-5365 after 5.

C-85 engine new major. D. Straley, 488 Fairfield, Gretna, La. 70053.

New 0-200A Cont. in factory crates in storage from sky scooter program, $4,500 outright. Adams, 234 N. Juanita Ave., Los Angeles, Ca 90004 (213) 487-2018.

A-75 engine 100 SMOH, Jim Banks (209) 734-7809, see at Del Air, Strathmore, Ca.

Lyc 0-235-C, 947 TT logs, $1300 torn down or $2500 overhauled. Hal Dunning, Bx 5606, Kirtland AFB, N.M. 87185 (505) 247-8591

VARIVIGGEN NEWS - by Mike Melvill

N27MS has flown approx 30 hrs since the last newsletter and is performing flawlessly. Very few builders responded to our request for information on VariViggens; come on guys. How about a first flight report from those of you who are flying? For that matter, we would really like to know how many VariViggens are flying.

I have heard from a couple of builders; Ken Winter has his upside down, and the sides and bottom are skinned and he is applying Dacron. Orville Winfield, and Charles Allen are both building the same main gear retract system as in N27MS, and both report good results so far. Orville has completed his, but not installed it yet, and it looks excellent. Incidentally my system has worked perfectly for 1-1/2 years, 260 hrs and over 320 landings, with no maintenance. While on the subject of the main gear system in my Viggen N27MS, which is now incorporated as the standard system in the new edition of the VariViggen plans, here are a couple of corrections to the parts list and drawings as supplied to those of you who have acquired the drawings for the new gear system from me.

The parts list calls out 4 KP6A bearings,; this should be 6 KP6A bearings. Add 2 pcs drill rod 5/16 dia x 4-3/16 long to the material list. On drawing #3, spacer WDG4 should be .340 not .250.

Aircraft Spruce & Specialty are now able to supply all parts reqd for the new main gear retract system. These are not premachined parts, some, such as the CD1145 worm gear will require machining.

The 12" dia spinner (long) available from Rattray, works well on the VariViggen, as it clears the starter better than a 13 or 13-3/4 spinner such as one from a Grumman Tiger.

Talked to Jesse Wright, the Viggen builder who supplies precut canard, inboard wing, fuselage bulkhead, and vertical tail kits. I had not seen one of Jessie's kits before and I must say I was impressed with the quality. If I was to do my Viggen project over, I would go with Jessie's kits, just for the time it would save. He also includes a very complete and helpful pamphlet.

Now, for "CP" 20, how about some progress reports? Also, we must try to have at least a couple of Viggens at Oshkosh 79.

INSTALLATION OF WING CUFFS - Refer to the sketches. The cuffs are a cambered leading-edge extension to the wing airfoil. If this is a retrofit, sand the paint off until patches of fiberglass begin to appear. We did not remove the wings to install the cuffs, but it is more convenient to do so. Nail the templates to the foam block and cut one L/H and one R/H cuff. Bond the foam piece to the wing with wet micro. Be sure the waterline is level and the cuff is pulled tightly onto the wing for cure. After cure, carefully remove the excess strips of foam and smoothly contour the shape back over the wing. The surface should not be lumpy or wavy (see "CP" 16, page 4). Glass with 1 ply BID at 45 degrees lapping 1" onto wing skin and peel-ply edges. After cure, apply featherfill or dry micro and sand entire cuff to a smooth contour. Use 1 ply BID and flox corners to cover bare foam at the ends.

SKETCHES AND PHOTO OMITTED

INSTALLATION & OPERATION OF WORM-DRIVE NOSEGEAR - The sketches below show the operation of the system. The NG50 arms travel 156 degrees, striking the NG14 spacers at each end of travel. It is over-center in the down position, thus, landing loads are not applied to the worm gear. The pilot's crank uses 10.8 turns for full travel, taking five to seven seconds. Previously you had to slow to 100 mph to extend the gear. You can now extend it at 140 mph, however, the crank is hard to turn above 130. When we first installed this system, we used it to lower the nose with the pilot in the airplane. This was successful until one time when the crank slipped, turned fast, then caught. The inertial loads failed the cast iron worm gear. It is possible that "cranking down" on the ground would be acceptable with the steel gear shown, but this is not recommended.

Use the plans chapter 17 procedure for installing the NG30 bulkheads - The NG14 spacers are the same. If your NG13's are installed, pop them out and bolt in the worm drive assembly. Check the assembly for freedom from binding before installation. It does not have to spin freely, just not bind up enough to make the crank hard to turn. If it binds, loosen the NG57 blocks and shim as required. The NG53 and NG58 gears must be accurately positioned to avoid binding. Use a gear lubricant on NG53 and NG60. Note that four AN960-516 washers are used to position NG58. One at the rollpin end and three at the other end. NG67 is a phenolic block with a 21/64" hole drilled at a 20 degrees angle. It is fastened to the instrument panel with two #8 screws. Install the crank and tube drilling the hole for the AN3-6A bolt with the crank in the best position to not block an instrument. Now, install the pushrod and adjust its length so the gear is pulled snug up just as NG50 strikes the aft NG14. Extend the gear and accept the down position. If everything is installed properly the pivot for the nosewheel fork will be vertical or canted bottom-forward slightly.

If you want to install a gear warning, mount the microswitch so it is engaged by NG50 or NG9 in its last ?/16" travel.

If you want to mount small instruments in the center piece, back-mount them. Make the hole in the panel 1.8" diameter maximum to leave sufficient panel stiffness.

NOSEGEAR WORM DRIVE PARTS LIST

No Reqd.	Part No.	Material
2	NG50	.125 4130N steel
2	NG51	.250 2024T3 alum
1	NG52	5/8 O.D. x .095 x 3" long 4130N tube
1	NG53	Boston gear CD1145-machining is required
2	NG54	Boston bushing FB1012-4
1	NG55	3/4" O.D. x .058 wall x 5/16" long 4130N tube

1	NG56	.125 2024T3 alum 2" O.D. x 1 1/4" I.D. x .125 thick
2	NG57	1/2" x 1/2" x 1" 2024T3 alum bar
1	NG58	Boston worm HDVH
1	NG59	MS20271B8 universal
1	NG60	5/16" O.D. drill rod 3 1/4' long
1	NG61	3/8"O.D. x .035 wall x 18" long, 2024T3
2	NG62	1/2" O.D. x 1/4" I.D. x .250 long 2024T3 alum
1	NG63	375 O.D. x 5/16" I.D. x 1/2" long 4130N steel sleeve
1	NG64	.062 4130N steel crank
1	NG65	5/16" O.D. x .035 wall x 2-1/8" long 4130N tube
1	NG66	Macrome wood bead handle
1	NG67	Phenolic block 1/4" x 1" x 1 1/2"
1	NG68	1/4" O.D. x .028 wall x 3/4" long 4130N steel tube

SKETCH OMITTED

NEW EPOXY REDUCES SENSITIVITY
We have been testing a new epoxy system that is a new development by Applied Plastics. It is formulated from completely different materials, resulting in a toxicity rating of SPI0, rather than SPI2 of normal epoxies. It promises to result in dramatically reducing the incidence of epoxy allergy. Also, its peel strength, exotherm, and water absorption is improved from RAE. In order to determine its actual toxicity under the conditions of VariEze construction, Applied Plastics plans to send samples of the new material to selected homebuilders who have experienced predictable rash when using the normal epoxy. If you have a sensitivity problem that prevents you from using RAE, send us a short letter, describing your symptoms, willingness to try the new system, and to report on its results. We will select a dozen individuals and provide them with samples to try.

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SKETCHES OF WORM DRIVE NOSE GEAR ASSEMBLY OMITTED

CP19, Page 8

SKETCHES OF WORM DRIVE PARTS AND FULL SIZE CUFF TEMPLATES OMITTED

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BELOW IS VARIVIGGEN SALES BROCHURE

THANK YOU FOR YOUR INTEREST IN THE VARIVIGGEN TWO + TWO SPORTPLANE

PHOTOS OMITTED

Performance with	Take off	850 ft
150-hp, fixed-	Climb	800 fpm

pitch prop, gross weight. Standard VariViggen	Cruise	150 mph
	Full Aft stick	49 mph
	Landing	500 ft
Specifications Standard VariViggen	Canard Span/Area	8 ft/18.3 square ft
	Wing Span/Area	19 ft/119 square ft
	Empty Weight	950 lb
	Gross Weight	1700 lb
Performance with 150-hp. Special Performance Wings Specifications	Climb	1000 fpm
	Cruise	158 mph
	Wing Span/Area	23.7 ft/125 square ft
Special Performance Wing	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, & AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73 and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY.
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips". Gas service and other airport services have been better too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS.
AIRCRAFT SPRUCE & SPECIALTY CO, 201 W. Truslow, Box 424, Fullerton, Ca 92632 (714) 870-7551
VariViggen spruce kit, plywood kit, hardware, aluminum and fiberglass. Catalog cost $3

KEN BROCK MFG. 11852 Western Ave, Stanton, Ca 90680 (714) 898-4366
VariViggen prefabricated components: all machined parts. Catalog costs $2

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave, Dayton, Ohio 45424
VariViggen plexiglass canopy. (513) 845 9872

MONNETT EXPERIMENTAL AIRCRAFT, INC., 955 Grace St, Elgin, Il 60120 (312) 741-2223
VariViggen molded fiberglass parts.

GOUGEON BROTHERS, 706 Martin, Bay City Mi 48706
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS, 4102 Twining, Riverside, Ca 92509
VariViggen welded nose & main landing gear, 1-1/4" sq. steel tube.

JESSE WRIGHT (VariViggen builder) 7221 S. Colorado Ct. Littleton, CO 80122 (303) 771-5140
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost description of car-top wind tunnel, 8"x10" glossy photo and current issue of newsletter. Price - $10.00 first class mail, $11.50 Air mail- overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price - $6.00 first class mail, $7.50 Air mail- overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, and flight reports as possible. Details mandatory, desirable, and optional changes to plans and to owners manual. A newsletter subscription and back issues starting with CP#19 are mandatory for those with VariViggens under construction. Identifies new material sources as they become known. Published quarterly. Price - $4.75 per year first class mail, $6.50 air mail overseas. Back issues, $1.00 ea.

VARIVIGGEN PLANS - SECOND EDITION. This is an updated, revised set of very complete drawings and construction manual consisting of a bound 11" x 17" book, containing many photographs, hints and instructions based on actual builders experience over the past several years. It covers the entire airplane, including the engine installation, fuel system, and not only covers the original standard wing in both aluminum and foam and fiberglass composite, but it also includes the composite S.P. Wing, ailerons, and rudders. The manual identifies sources for all required materials and all available prefabricated parts and components. Price - $165.00 first class mail, $177.00 Airmail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18% - size radio-controlled model airplane built and flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment and engine in the .35 to .65-cu inch size. 555-sq inch wing area.

All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines). Price - $4.75 first class mail, $5.50 air mail overseas.

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VariEze

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $2600 (less engine) in about 1000 man-hours, or from prefab parts and materials, costing approximately $4000 in about 600 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect and repair. The VariEze uses the small four-cylinder Continental aircraft engines. The 0-235 Lycoming, stripped of starter and alternator, is now being tested and should be available soon. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 20 gallons of fuel. Frontseat passengers up to 6', 7"/250 lbs and backseat passengers up to 6', 5"/220 lbs can be accommodated plus a modest amount of baggage in two custom suitcases. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (60 kt/70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE TEST PROGRAM The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin

and dive tests to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

THE HOMEBUILDER SUPPORT The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher," published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit, includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter, published quarterly. One-year subscription	$4.75	$6.50
Section I	$139.00	$153.00
Section IIA	$19.00	$21.00
Section IIC	$21.50	$23.50
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95
Add 6% if Calif resident - newsletter is not taxable.		
*U.S. FUNDS ONLY		
TOTAL		

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound, 11"x17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

SECTION IIA - Continental A65, A75, C85, C90, 0-200

SECTION IIC - LYCOMING 0235 - No accessories.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operational handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS & PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP @ GROSS WEIGHT:

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	560 lb
Gross Weight	1050 lb
Range @ Max Cruise	700 mi
Range @ Econ Cruise	850 mi
Min Speed (full aft stick)	55 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6 square ft
Canard Span/Area	12.5'/13 square ft

SPECS & PERFORMANCE WITH 75-HP CONTINENTAL:

Take Off	1050 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	530 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

AIRCRAFT SPRUCE & SPECIALTY CO. or WICKS AIRCRAFT SUPPLY
201 W. Truslow Ave, Bx 424 410 Pine
Fullerton, Ca. 92632 . Highland, Il. 62249
(714) 870-7551 (618) 654-7447

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton, Ca. 90680 (714) 898-4366: Prefabricated components - wing attach assembly, nosegear

machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, 6 Mojave Airport, Mojave, Ca 93501, (805) 824-4558: Prefabricated components - cowling, fuel tanks, wheel pants, maingear & nosegear struts, strut cover & nosegear box. Send SASE with 3-oz postage for brochure.

THE AIRPLANE FACTORY, 7111A Brandtvista, Dayton, Oh 45424 (513) 845-9872 or 233-7754 - Canopy.

H.C. COMMUNICATIONS, Bx 2047, Canoga Park, Ca 91306, (213) 882-0422. Custom COM & NAV VHF antennas.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Ken Swain's EZ at Oshkosh - wide angle lens. Photo by Ken Swain.

Fred Keller, Nat Puffer and Bud Bryan over Lake Winnebago during Oshkosh 78. Photo by Howard Levi.

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THE CANARD PUSHER NO. 20 APR 79

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 20. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 20. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 20. If you are building a VariEze from the 2nd Edition plans you must have newsletter 16 through 20. A current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 9:00 to 12:00 and 2:00 to 5:00 on Wednesday through Saturday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions" This will speed our reply.

RAF ACTIVITY since the January Newsletter has included construction of a new EZ, builder support, development work on the Defiant, and extensive flying of our Defiant, VariEze and VariViggen for airshow practice. We have flown a three-aircraft airshow demo each Saturday at Mojave for the last several months. The new EZ under construction (N79RA) should fly by mid May. It will be powered by a Lycoming 0-235. It will be the test aircraft to flight-test the Jiran prefab wings.

The adjacent photos show the RAF crew, so you can become better acquainted with those who you may only know as a voice on the phone. Sally and Mike Melvill, builders of N27MS, the award-winning VariViggen have been with us since October. Both are excellent pilots as well as airplane builders. Their experience in building both a VariViggen and an EZ and in understanding the needs and problems of the homebuilder, is a most important asset to RAF. Also pictured are Dick and brother

Burt Rutan. Dick joined RAF a year ago after a 20 year hitch as a USAF Fighter Pilot. **PHOTOS OMITTED**

CP20, Page 1

CONGRATULATIONS! to the following who have made VariEze first flights since the last newsletter:

Dan Lee	California
Darl Hess	Florida
George Dirks	New Mexico
Jim Ball	Missouri
Gary Johnson	Texas
Mr. Griswald	Arizona
Ray Cullen	Oregon
Carl Gearhart	Penns
Brian Giesier	Colorado

There are probably more, but these are all we're aware of. Be sure to give us a report when you fly. This is very important to us so we can best support others. In particular, if you have had any problems or have found any improvements that would aid other builders, be sure to let us know so we can pass them on in the Canard Pusher.

THE AD-1 was delivered to NASA's Dryden test center last month and immediately began taxi tests. It is now being instrumented with a data system and should be flown in June. The AD-1 started as an unsolicited proposal by RAF to NASA in December '75. RAF did the detailed design between May 76 and Feb 77 under a $12,000 contract. AIC, of Long Island N.Y., won the construction contract and started construction in December 77. They delivered the flight-ready aircraft, including a static load test, in February 79 for a total contract cost of $239,000. Until recently, the aircraft industry did not believe it was possible to design and build a manned, skew-wing, twin-jet research aircraft for less than several million dollars. It is interesting to note that the total work done by RAF and AIC was done at a profit and at far less cost to the taxpayer than the NASA tasks of overseeing the contractors and doing a simulation! While we expect the AD-1 to provide the basic subsonic skew-wing stability data it was built to provide, we expect its major impact will be that it is possible for the government research agencies to procure a truly low-cost aircraft, working with a small contractor and employing the moldless composite construction similar to the VariEze.

DEFIANT We have decided to proceed with a type-certification program on a light twin based on the Defiant prototype. It's cabin design is completely different from the prototype. It has a clamshell door with roomy seating and baggage for five adults. Specifics on its configuration, performance, etc will not be released until it is in flight test in late 1980. Certification is anticipated in late 81 or early 82. Meanwhile, we continue to gather operational data on the Defiant prototype, N78RA. Last week it flew nonstop from Mojave to Wichita (1265mi) at 17,500 ft, at 175 knots, burning only 5.4 gal per hour per engine, landing with 1 1/2 hour fuel on board. It is being evaluated in the IFR environment, including approaches at minimums, a zero-zero takeoff (actual IMC), and light ice on four occasions. It

has seen 270 hours of very vigorous testing of all types including aerobatics and spin-attempts, and has yet to cut a flight short due to a precaution of any kind. Due to the fact that we are doing this program with very few people and very low overhead, we will not have time to respond to questions, etc on the Defiant for the next two years. We plan to be very low key on release of any information or promotion of any type. This newsletter will report any releasable progress as we proceed. If you do want an advance look at the Defiant's capabilities and are interested in beautifully-done sound film, send a SASE to Ferde Grofe, 18139 Coastline Dr. Malibu, Ca 90265. for his flyer on the new film "Defiant".

JIRAN'S PREFAB WINGS - STATIC TEST Burt, Dick and Mike were present when Fred Jiran static loaded his VariEze prefab wings and centersection. NASA was also there, and had installed 24 strain gauges all over the wings and centersection spar. The wings were loaded to the design limit of 7.5 gs with no problem whatsoever. In fact, due to a calculation mistake we had earlier loaded them to 8.25 gs and almost twice the expected torsional loads. The strain gauges verified adequate stress margins at all measured locations. We will begin a thorough flight test program on these wings and center section (the same ones that were used for the static proof loading) here at RAF next month. Look for a full report in CP #21.

CAUTION - OVERWEIGHT! It has come to our attention. that some VariEze builders are operating their VariEze's in an overweight condition. This is a high risk activity and an extremely hazardous practice.

Every VariEze builder should know, the maximum gross weight is 1050 lbs. Under certain restricted conditions this can be raised to 1110 lbs for takeoff only - (see CP #14, page 5). Attempting to operate above these weights and/or using higher than recommended horsepower, definitely raises your risk above an acceptable level.

Takeoff's, landings, off-field landings, maneuvering, or flight in strong gust conditions may result in an accident that could destroy your aircraft. Never operate above the recommended gross weight. An accident can compromise the freedoms of all homebuilders. Please do not let it happen.

VE STALLS Dan Lee, of Livermore, Ca has installed wing cuffs per CP #19. Prior to cuff installation Dan had on four occasions experienced divergent wing rock, resulting in departures and spiral recovery rolling dives. (CP #19). His post-cuff installation flight report follows: "I did not get a stall with or without power, only a slightly perceptible wing rock, power off at full aft stick. The overall effect on slow speed flight control is great, as is the improvement in confidence and peace of mind". Do install the cuffs exactly as shown in CP #19.

VE EXHAUSTS There are now at least four VariEze's with over 300 hours, two of these are 0-235 Lycoming's one of which has standard exhausts as per Section IIC with no problems. 0-200 Continentals, have not been so fortunate. The muffler system though heavy works very well, at this point we have removed it and consider it to be a proven exhaust system. In its place on N4EZ we recently installed an exhaust system designed and built by VariEze builder Herb Sanders of Memphis. This is the

exhaust that exits out of the trailing edge of the cowling. We only have 25 hours on it so far and Herb has 70 hours on his, so it is too early to be certain, but so far it looks good. It is not as quiet as the muffler system, but is half the weight, and simplifies cowling removal. We shall have to wait until we have 150 hours or so on the system before we categorically recommend it, but the concept and workmanship is good.

The cross-over system is structurally sound and does increase power. However it cannot be adequately faired on a VariEze to prevent massive airflow separation in the aft closure. This causes high prop noise and a 15 knot speed penalty.

We will be testing an entirely new system on our new EZ.

CLARIFICATION - VARIEZE ENGINE WEIGHT
240 lbs is mentioned as a maximum weight of engine, prop, prop extension, exhausts and spinner in Section II. This weight is the maximum allowable vibrating mass and does not include engine mount or cowling. Maximum engine and accessory weight is 215 lb.

WIDE CHORD ELEVATOR - STABILITY AND STALLS Many builders have been confused about the various aerodynamic effects of shortening the canard and widening the elevator. The reason for the confusion is that the effects are not what one would immediately think. Hopefully the following discussion will clear the air:

Question - the wide chord elevator is bigger and thus gives more effect per degree - why doesn't this make the controls more sensitive?
Answer - sensitivity is more a function of effect per stick force, not displacement. True, the wide chord increases effect per degree by about 12%, but the distance from the elevator's center-of -pressure to its pivot is twice as far, thus stick force per effect is nearly doubled.

Question - I understand why shortening the canard moved my airplane center of pressure (and cg range) back 1.2 inches due to less area on front. But, why didn't the cp move back forward, when I installed the wide-chord elevator, thus increasing canard area?
Answer - The wide chord elevator has a negligible effect on aircraft static stability for two reasons, (1) the elevator "floats" when angle of attack changes. Thus it's area has much less effect on stability than the fixed canard area. (2) The wide chord elevator results in less, not more, aspect ratio, as compared to the area added by increasing canard span.

Question - Since the wide-chord elevator has more aerodynamic power, it should be able to drive the airplane into a deeper stall, correct?
Answer - No, the airplane's maximum angle-of-attack is limited by the stall angle of canard airfoil. Adding more elevator can get it to stall with less elevator position, but it will still stall at the same angle, and still limit the aircraft to a safe attitude without stalling the aft wing. Note that even though a large elevator can increase the maximum lift coefficient of the canard, larger elevators actually

decrease the stall angle and thus cannot increase the angle seen by the aft wing. The aft wing angle is the main factor for stall characteristics.

LANDING GEAR There have been two reported main gear failures, in which we suspect 'creep', since these occurred on overweight airplanes in hot temperatures. The failure was on top of the main gear strut between the mounting tabs, and showed up as a wrinkling or buckling of the BID wrap. This may have been aggravated by not "setting" the gear (ref. CP #18 page 5). Main gear "creep" will also show up as a slow long-term reduction of wheel camber or increase of gear spread (distance between wheels). We now recommend the following:

1) Be sure to 'set' your gear after every flight.

2) Inspect the top of the main gear strut, between the tabs, through the hole in rear seat bulkhead occasionally.

3) For new VariEzes under construction. Sand the entire gear strut dull and lay it trailing-edge down. Using RAEF, lay up three plies of UND spanwise from axle to axle, draping each ply from trailing edge over the leading edge to trailing edge. Be sure fibers are straight. After cure, sand trailing edge smooth and apply the two plies of BID, one from the leading edge and one from the trailing-edge, per CP #15 page 6. Before laying up the attach tabs per CP #14 page 6. These three plies per side of UND will stiffen your gear about 15%.
SKETCHES OMITTED

4) If wrinkles, or loss of camber, or spread is noted in operation, remove the main gear strut, remove wheels, axles and brake lines. Strip off the tabs and thoroughly sand the entire strut. You may see evidence of compression fractures on the top surface of the gear. These can be repaired as follows: Lay up seven plies of UND, three plies from axle to axle (per #3 above) and the remaining four plies lay up 4" shorter on each side progressively, (see sketch). Then apply the BID and tabs, per #3 above. **SKETCH OMITTED**

EPOXY Applied Plastics has sent out about 20 samples of the new low toxicity epoxy, but it is too early for us to have received any reports. We have used it here at RAF on our new EZ. If we receive positive results on the toxicity tests and the system passes all structural and workability tests, it will replace the current RAE systems.

While we are on the subject of epoxies, I would like to remind you to be as accurate as you can when using your ratio balance. Make sure the pivots are clean and work freely. Mixing epoxy requires far more accuracy than mixing polyester (boat resin). If you think of your resin as a bunch of "threaded bolts" and of your hardener as a bunch of "nuts", you will see that only with a perfectly accurate mix do you have one "nut" for each "bolt". Only the molecules "bolted together" as it were, do any good. So the greater accuracy you use to ratio your resin-hardener, the stronger your epoxy (and VariEze) will be.
SKETCH OF SCALE FOR NON TOXIC EPOXY SYSTEM OMITTED

CONTROL SYSTEM ROD-ENDS The VariEze control system is unusual in that it uses the small HM-3 rod-ends in its primary controls. Aircraft normally use the 1/4" hole HM-4 as the minimum size. Justification for this is that the control surfaces are small, sized for the low forces required for a sidestick control. Thus, the design safety factors are still larger than in normal control systems. However, the small HM-3 rod-ends are relatively fragile if they are subjected to bending or twisting loads. These loads do not exist in operation, but they can occur when the canard is being removed, or at the stick if the roll stops are not adjusted correctly. We recently heard from a builder who broke an HM-3 while he was installing his controls! This is a very serious concern, since there is no redundancy in the pitch system to save the airplane if one should fail in-flight. This is not as serious in the roll system, since the airplane can be steered with rudder or the other aileron. Due to the relative frailty of these rod-ends, we are recommending that you immediately replace the four primary pitch rod-ends with HM-4's as shown in the adjacent drawings. This includes both ends of the CS136 tube and both ends of the CS102 tube. Note that two CS201 spacers are required for each rod-end on the CS102 pushrod to allow sufficient roll travel. They are steel, 5/16 OD x 1/4 ID x 0.1 long. Also, the two CS111 spacers are replaced by CS202 spacers. Four of the CS1 inserts now are CS1A (1/4" x 28 thread). Note that this change also effects the parts list on several bolts, washers and nuts. Drawings for CS1A, CS201 and CS202 have been supplied to Brock so he can manufacture them. Aircraft Spruce and Wicks have all the new hardware in stock. If you are retrofitting you can drill (#3 drill) the CS1 spacers and tap 1/4 x 28 thread. **SKETCHES OMITTED**

VARIEZE PLANS CHANGES

Section I pg 18-1 — add "see CP #20 for installation of three plies UND on strut before the BID wrap"

Section I chap 19 — add "pitch system rod-ends from the elevators to the front stick (four total) have been changed to HM-4 size. See CP#20 for details".

Section I pg 2-1 & 2-2 — Revise the bill of materials as follows to reflect changes required to change to the HM-4 rod-ends.

Subtract

(4)	HM-3	(1)	AN3-11A
(4)	VECS13	(1)	AN3-15A
		(1)	AN3-16A
(4)	MS21042-3	(1)	AN3-7A
(2)	CS111 Spacers	(4)	AN 315-3
		(4)	CS1 inserts

Add

(4)	HM-4	(1)	AN4-7A
(4)	CS201	(1)	AN4-12A
(2)	CS202	(2)	AN4-16A
		(4)	AN316-4

(4) MS21042-4
(4) CS1A inserts

BUILDERS HINTS When you cut BID or UND, mark the cloth where it will cross the center line with a fine felt marker. This mark can be very helpful in perfectly aligning such lay ups as canard spar caps, etc.

Draw lines (broad felt tip marker) on your glass cut-out table at 45 degrees to the sides on 6" centers. This is a big help when cutting BID.

Be careful when storing foam blocks, not only can sunlight ruin it but rats and mice love to dig tunnels in it!

Finding fuel tank leaks. Purchase a can of Freon from your friendly auto air conditioner repair man, and borrow his Halogen gas sniffer. (This may require some persuasion!). Squirt some Freon into the offending tank, replace the cap, and pressurize the tank, (blow into the vent). Use the sniffer to locate the leak or leaks, mark them carefully and repair per CP #14 pg 10. This method will find even the tiniest pin hole leaks.

Check your maingear toe-in. This can really effect the life of main tires. See the accompanying sketch, and clamp or hold one 36" long straight edge on the outside of each main wheel, be sure it touches the rim both fore and aft of the axle. Position of the straight edges fore and aft is not important, as long as they are the same. Measure accurately the distance between the ends of the straight edges at 'A' and at 'B'. For 1/2 degree to 1/4 degree of toe-in per wheel A-B=0.3" to 0.7". **SKETCH OMITTED**

An excellent cowling idea from Herb Sanders - Instead of gluing your cowling rib to the bottom cowl, glue it to the main wing root. This allows you to better fair the cowling in with the wings, and makes it simpler to remove the cowl, as either the bottom or top cowl can be removed independently of each other without hitting rudder cable or aileron tube. This requires four more camlocs (or screws) on each side in the bottom cowl. The only time this would not be convenient would be for the builder who intends to trailer his EZ to and from the airport, requiring frequent wing removal. We have modified N4EZ to this configuration to test the Jiran kevlar cowl and are very pleased with it.

Jim Eggleston wired up his instrument panel before installing it in the fuselage. He then bound all the wiring into a harness, color coding the wires and tagging each wire. The harness was then removed and the panel installed. See photo.

Jim also reports that he used dead soft .016 aluminum, called handyman's metal, obtainable at the hardware department of Montgomery Ward's in rolls, to make his hotwire templates. This material can be cut to size (after paper templates are glued on) with ordinary scissors.

Before floxing VECS3 hinges into your canard, bondo small wood blocks adjacent to the VECS3's and overhanging the slots cut in the canard. VECS3's can now be clamped to these blocks, templates can be removed from under the elevators, and the elevator travel can be checked before final potting in flox. Leave clamped until set. This tip from Minnesota's EAA Chapter 587. **SKETCHES OMITTED**

When countersinking difficult to reach holes, e.g. 3/16" dia holes in engine mount extrusions, a 9" long piece of 5.16" dia x .035 wall aluminum tube can be used. Drill and tap a 1/4 x 28 thread in one end and screw in a 100 degree countersink with a 3/16" pilot. **SKETCH OMITTED**

Many builders have requested a summary of weights of each individual part. These are weights of the parts before any finishing.

Complete wing/winglet aileron assembly	43 lb	
Above, after finishing	46 lb	
Winglet before cutout for rudder	2.6 lb	
Canard (142")	16.5 lb	
Elevator (left)	3.6 lb	with balance weights
Elevator (right)	3.3 lb	with balance weights
Wings (each)	34.0 lb	
Ailerons	3.5 lb	
Center Section Spar	21.0 lb	
Fuselage (at end of chap. #12)	65.0 lb	including C/S spar
Canopy (end of chap #22)	14.5 lb	

When cutting out small BID circles, as in bolt hole reinforcement in NG30's, fold up BID cloth strips to required number of plies (30) and clamp between two scrap pieces of 1/4" plywood (firewall material). Vice grips work best. Now cut through plywood and glass with fine tooth coping saw or band saw. Presto perfect circles of BID!

Gear and canopy warning - this system has a resetting defeat feature. The main advantage is the ability to silence the horn, while doing gear-up, slow flight or descents. The light stays on as long as the throttle is retarded. Each time you cycle the throttle the horn will sound and will have to be re-silenced. This eliminates the possibility of switching the warning system off during gear-up descents, and forgetting to rearm it for the landing approach.

Side consoles and control system installation - a simpler way. The adjacent photos show how we did it on N79RA. Note how only the forward three inches of the aft console is installed. After controls are installed the remainder of the console will then be permanently

installed. Note how large cutouts are removed from the forward console to get access to the stick and forward belcrank. After controls and trim springs are installed we will fabricate a three ply glass removable cover over the stick area. **SKETCHES OMITTED**

SKETCH OF JIM EGGLESTON'S INSTRUMENT PANEL OMITTED

PVC FOAM COLORS
Several builders have accidentally used 9mm PVC foam for their F22, F28 and instrument panel bulkheads. The confusion has arisen through variations in color of the PVC foam. Rather than going by color check the thickness and obvious density. The 5mm(.2") high density foam is more dense than the 9mm (3/8"). It has a smoother texture - finer cells than the 9mm, which has a course texture with a larger cell structure. If you are one of the builders who has made this mistake, here is the fix. The only area that is a structural problem, is F22 where the canard lift tabs are attached. To stiffen this area you should dig out the foam as shown (use a 1/4" drill) and make four (4) 1/4" birch plywood inserts (scrap firewall material), which should be a nice snug fit, and should be glued in with wet flox. This mistake will, of course, also necessitate longer VECN1 bushings. This fix will provide adequate bearing strength, and structurally the airplane will be more than satisfactory. **SKETCHES OMITTED**

SHOPPING
D and J Coats have come up with a really fine VariEze belt buckle, see photo. It comes in a brushed or polished finish. Orders can be turned around in three to five days from receipt of order. **PHOTO OMITTED**

Write - D & J Coats,
P.O. Box 2679
Taos, N.M. 87571

Radio Shack has a 12v warning horn suitable for gear/canopy warning. Model #273-051 for $1.89

Calectro, G.C. Electronics, of Rockford Illinois 61101, has a mini meter # D1-941 in the 0-500 ma range for $10. that measures 1 1/8" square, and is good for measuring power output of your solar cell.

Bud Gross, an E-Z builder has designed and built expressly for a VariEze, a really good looking trailer. He will send you a flyer with pictures for $1.00 and SASE, or you may order construction drawings for $20.00.

Write - C.A. Gross,
392 Tiger Tail Drive.
Arroyo Grande, Ca 93420

ROTORWAY RW-100 ENGINE IN VARIEZE - Our earlier plans to test this engine this spring in N4EZ have been postponed. Several items must be improved by the engine's manufacturer before it will be acceptable for us to begin the installation test: Currently, the installed weight of this engine, including the accessories required for it to operate is above the maximum allowable weight for the VariEze. The engine needs an alternator because of its electric fuel pump requirement and a starter since it cannot be hand-propped. It currently has no provisions for alternator or mechanical fuel pump, yet needs 3 psi fuel

pressure. The current configuration at 92 BHP and greater than 240 lb (installed) is marginal for a VariEze.

We are, of course, hopeful that this or any new engine will become available to supplement the availability of Continental and Lycomings. We are working very closely with Rotorway and will do our best to support and assist in its successful development. When Rotorway prepares a configuration that we consider acceptable for the VariEze, we will immediately begin an aggressive flight test program with it in N4EZ to develop the information necessary to make a determination on its acceptability and to prepare an appropriate Section II.

However, our ethics require us to caution our builders to beware of any new product until it has been adequately developed and tested.

CP20, Page 6

WANTED

85hp Continental C85-12F
Earnest Deel
3710 Maple,
Warren, Mi 48091
(313) 756-3794

NOTE!! Can't find an engine? Run an ad in Trade-a-plane, Crossville, Tenn 38555, and let us know what kind of response you get!

FOR SALE

0-200 A Continental. '0' since major, 100 octane valves, balanced, with all accessories, including prop extension, VariEze engine mount, Section IIA.

Conlan Carter
P.O. Box 7366
Van Nuys, Ca 91409
(213) 761-4636

Continental C-90-8F with 0-200 cam - 100 hp. '0' since major. No provision for mounting starter or alternator, very light $3,100.00. Call (904) 878-5858

Michael P. Fisher, has brand new Continental 0-200 as well as remanufactured 0-200 engines for sale at reasonable prices. Write him at

8800 Coventry Drive.
Sturtevant, Wi 53177

A lot builders have reported excessive costs for engines. It seems most insist on a 0 since major engine. Why not use a half run out engine? It runs cooler than a new overhaul and can give years of operation before next major. Both our VariViggen and VariEze prototypes N27VV and N4EZ started life with 1300 hour SMOH engines. We just now bought an 0-235 Lycoming for our new EZ for only $1500. It has 1350 hours and was removed from a Yankee for installation of an 0320. We expect to get a full 700 hours before overhaul, a bargain for $1500!

ACCIDENTS since the January newsletter there have been two VariEze accidents.

The first accident was in Michigan, when a VariEze was attempting to land. It was slow on final, developed an excessive sink rate, hit hard then cartwheeled while bouncing about 30 feet into the air, and coming to rest inverted in a snow bank. Other than a small abrasion on one knee the pilot was not hurt. The EZ was substantially damaged. The pilot had 2.5 hours in his VariEze, all operating from a large airport. He had not flown in the previous three weeks due to bad weather. On this flight he was attempting to land on a 2850 ft runway with power lines and trees on both ends in a 10 knot cross wind. The runway was covered with snow except for a 45 ft wide path in the center and there were 3.5 foot high snow banks on each side. Ground witnesses reported the pilot attempted two landings but got slow on each and went around. On the third approach he once again got real slow in a nose high (estimate 30 degrees) attitude, developed heavy wing rock, and a high sink rate. He hit hard, spread the main gear strut straight out and then caught the snowbank and cartwheeled.

The second accident occurred March 7th. Just after take off from the Tims Airport, Austin, Tx. The take off and initial climb to a few hundred feet were observed to be normal, then the aircraft appeared to lose control, descending in a very steep angle and crashed about three miles from the airport. Both occupants died instantly. The aircraft had over 80 hours flying time. It had been tested extensively and had never demonstrated any unusual flight characteristics, according to the previous owner. Working with the FAA investigator, we found no indication of structural failure, control disconnect or engine failure. An examination of the canopy locking system revealed that the canopy was not locked at impact. The aircraft was equipped with the canopy safety latch and its damage showed the canopy was open approx. 1 1/2" and engaged in the safety latch at impact. There was no canopy unlatched (light/horn) warning system nor inside canopy closing handle installed. The aircraft was within the allowable gross weight and slightly aft of the aft cg limit.

The pilot had just recently purchased the aircraft a few days before in Alabama. He had a total of about 10 hours in the VariEze, mostly cross country time. According to the previous owner the pilot experienced considerable difficulty checking out in the VariEze, even though he had several thousand hours time and was Lear rated. Before the pilot left Alabama, the previous owner had made it clear that he was marginally qualified in the aircraft and should improve his proficiency before carrying passengers.

Since the canopy was unlocked at impact it would indicate the pilot had failed to complete his take off check list and took off with an unlocked canopy. It appears that the distraction of the canopy opening against the safety latch, combined with a possible panic stricken passenger (it was the passenger's very first airplane ride) might have caused the pilot to lose control of the aircraft.

There are three other documented cases of VariEze canopies opening in flight. All three were able to control the airplanes to a landing, even though they were holding it down with fingers outside the canopy frame (two inches open). With canopy open (2") in the safety latch,

other than a moderate wind blast, VariEzes can be controlled and landed normally. The following is a first-hand account of such an incident by Les Faus. "Burt asked me for few words about how it is to fly a VariEze with the canopy open. Mine opened at about 50 ft and 100 mph. I fortunately had a back seat passenger that I could rely on. Between the two of us we were able to close the canopy without too much trouble. With the canopy full open, the plane tends to pitch up and to the right. I put the stick into the left front corner and eased back and just held it straight until we could ascertain the damage. The back seat passenger held the canopy closed while we flew 15 miles to another larger airport for landing. The airplane flies well with the canopy being held with your hand around the frame. About 2" open. At that time there was no safety lock on mine. The only damage to the canopy was the center arrow stock broken by the back seat passenger trying to close the canopy. If this happens to any of you, don't panic. The airplane in controllable and can be saved. It sure gets the hair up the back of your neck at the time though!!"

Note: In 1977, Peter Krauss had a similar opening on take off while flying solo and he held it down and landed while using his right hand for control and throttle.

Any kind of accident is unfortunate. It would be even more so, if we did not try to find out why and try to prevent it from happening again. Possibly both of these could have been prevented if the pilots had carefully followed the procedures in the owners manual and newsletters, especially in the area of initial flight testing and pilot proficiency. We urgently request that the guide lines established in the operations of this aircraft be followed. Review them, be sure the warning systems are installed and operational. Follow the owners manual to the letter.

To review an Air Force adage on how to handle any emergency.

1. Maintain Aircraft Control
2. Analyze the situation
3. Maintain Aircraft Control
4. Take proper action.
5. Maintain Aircraft Control

Many have crashed light aircraft due to doors coming open, even though the airplanes fly acceptably well with the open door.

Be aware of your proficiency and the capabilities of your aircraft and don't stretch either one. Never operate at the edge of any limitation unless you need to and your proficiency is excellent. This applies to everything - weight cg, red line speed, approach speed, airport size, allowable g - etc. Limits are just that - Airplane limitations. Flight near the limitations normally require more pilot skill on any aircraft, particularly high-performance ones.

CANOPY SAFETY PHILOSOPHY There aren't many things on the VariEze that a pilot can forget that will hurt him. Failure to extend the gear prior to landing will only cause superficial aircraft damage. But forgetting to lock the canopy can be a very serious problem. I see some EZ's flying without the safety latch or a warning system and ask,

why? The response is "I am a good pilot, I always use a check list and would never forget it". Let me categorically state that no matter how good or conscientious you may think you are there will develop a set of circumstances that will lead into an error of omission.

All of us here at RAF have, at least once, taken off without locking the canopy. Each time it happened was when the "normal" procedure was interrupted by something abnormal, such as a change in runway, followed by an immediate takeoff clearance. This can and eventually will, happen to you. Having separate, redundant latches that you have to close, will not protect you. You need the catch and warning to protect you when you forget.

Some of you have found that the stainless steel SC1 catch (CP #17 pg 6 is difficult to carve out. We have released a drawing of it to Brock, so he can have them punched out and should have them available for sale.

We have seen several cases of EZ's getting too slow on final, rounding out too high and landing hard. In one case this was attributed to an error of 30 mph in the airspeed indicator. This will not happen if you fly by attitude. If you cannot see the horizon over the canard you are getting far too slow - go around and try again. One good technique is to fly final at a speed that puts the canard three to five degrees below the horizon. You should always be able to see the runway over the nose, then start the flare and fly it down to the runway in a controlled rate of sink to touch down, without ever flaring the canard above the horizon. This will give the shortest distance, since an extended over-flare will use up a lot of runway.

Remember, if you sell your EZ, you have the responsibility to inform the buyer of any deviations from the plans. Also, be sure the new owner is thoroughly knowledgeable with the owners manual, operational procedures, newsletter, and that he should keep up to date with a subscription to the Canard Pusher. This is the only AD system and all VariEze operators must subscribe.

VARIVIGGEN NEWS
Builder Reports - Jim Saunders of Miami, Fl has flown a really superb VariViggen, N17VV, basically white with red, orange and yellow trim, that has to be the prettiest paint scheme I have seen. Congratulations Jim. Unfortunately after logging only 12 flight hours on his Viggen Jim had a main gear malfunction. His right main collapsed on landing, due to a broken cable, which caused substantial damage. However he has redesigned the main gear system and repaired all the damage and is ready to fly once again. Jim, we are all looking forward to a complete flight test report, and hope to see you at Oshkosh.

Jim Edgar flew his Viggen N101JE on March 13, 1979, he had previously had problems with the cable in the gear retraction system, and in fact had his nose gear collapse on a high speed taxi run. He has repaired it and says it flies hands off. He hopes to make it to Oshkosh.

John Poehner, of Flushing Michigan has his Viggen, N29X, complete and ready to transport to the airport. He only awaits hangar space, and then we should get a first flight report. Lots of luck, John.

Ken Guskott reports that his Viggen N106VV, is very nearly complete. He is in the final stages of engine/cowling installation now. He hopes to fly in early summer, and says he will be at Oshkosh.

Charles Allen has just completed his canopy installation and reports good progress.

Ken Winter and C.M. Schwartz both have their Viggens upside down and the bottom skinned. They had the foresight to apply the dacron to the bottom while the aircraft was inverted. When I built N27MS, I was not that smart, and ended up putting dacron on the bottom, with the aircraft on the gear, and that is quite a trying job! We have one Viggen well along in Australia and at least three in New Zealand. Obtaining parts that far from suppliers can be a problem. Des Whitfield reports that a fiberglass cowling for the Viggen cost $1100 to get to New Zealand!

At least two builders have completed the main gear system as used in N27MS. This is now standard in the Second Edition of the VariViggen plans. For those of you with the first

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edition who may want a set of the drawings for the main gear system, these are still available from me, here at RAF in Mojave for $10.00 a set.

I now have on record seven VariViggens that have flown and at least two more that are complete and ready to fly. Who knows, maybe we will be able to put up a three ship or four ship formation of Viggens at Oshkosh! Now that would be neat.

VARIVIGGEN SHOPPING

Tony Manis reports that he recently obtained a set of rubber shock donuts for the main gear from Borg Warner in Toronto Canada. These parts are listed as - Borg Warner #31-2014
Anchor #31-2014
Amr. Parts #2-204
and all are exactly the same part. Since quite a few builders have reported difficulty in obtaining these parts, I would appreciate information from anyone who knows of a good source.

Bill Campbell is once again in a position to make pulley brackets and associated metal parts for the Viggen. He also has a large supply of the original 2 1/2" dia LS-806 pulleys available. Anyone interested, please write to Bill at -
P.O. Box 253
Phelan, Ca 92371
(714) 249-6218

For sale - VariViggen project - contact
Bob Eldridge (805) 965-8107

VARIVIGGEN BUILDER TIPS

For those of you building the S.P. wing or standard wing in composite, the S.P. wing plans showed the wing root as two plies of BID with flox

corners. We now recommend a better method of laying up the root rib, which is stronger and allow for much easier fitting of wing root to inboard wing, as you can trim the edges for a perfect fit. This can also be used in the S.P. wing aileron tips. See sketch. Layup top and bottom skins normally. Then, after cure, remove .6" of foam from root of wing (or aileron) with a router, dremel, or knife. Sand the exposed inside of the skins, and lay up two plies of BID at 45 degrees to form the root rib. This method is used in the Defiant and make a stronger corner. **SKETCHES OMITTED**

Don Alspaugh of Lithonia Ga, sent in this suggestion for a scarfing jig. The Viggen strength comes from its stressed skin. Good scarf joints of at least a 10:1 ratio are essential.

1) Cut a piece of 1/2" or 3/4" plywood the same size as your table saw top, and clamp it below the surface, to the table with the saw blade below the table, and a guide piece in the miter gauge channel. 2) Turn on the saw, tilt the blade to 5 degrees. Raise the blade to approx. 3 1/2".
3) Select a straight 2" x 4" cut to the length of the table, and lay it parallel to the saw blade just about touching the blade. Accurately mark its position.
4) Remove the plywood top and 2" x 4" and glue and nail it into place.
5) Cut a second piece of plywood, cut elongated holes as shown for carriage bolts, and glue and nail another 2" x 4" to its edge.
6) Place this piece of plywood on top of the first piece. Mark the location of the carriage bolt holes, drill two holes in the first piece of plywood and counterbore them from underneath, so that the carriage bolts are recessed flush.
7) Clamp the two pieces of plywood together using large washers and wing nuts, and replace the fixture on your table saw.
8) Test cut a few scrap pieces and adjust it until the correct sharp edge is obtained (no feathering). Now nail through the plywood into the piece in the miter gauge channel. This piece should be glued. See sketch. **SKETCHES OMITTED**

VARIVIGGEN OWNERS MANUAL CHANGES The best rate of climb speed is not correct in your owners manual, and should be corrected to read 104 mph, not 80 mph as shown. VVOM pg 11. See climb chart below. **GRAPH OMITTED**

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Jim Saunder's Viggen on first flight.

"I am enclosing a picture of the big day---June 14--- when Jess N. Larson, GATO inspector representative from the Minneapolis office, presented me with the airworthiness certificate. The picture shows myself on the left receiving the certificate. In the cockpit is Leo Zeug, my co-builder, who won the coin toss and made the first flight. I followed ten minutes later. The airplane flies beautifully."
Ed Wieland

Everyone is relaxing on the AD-1 wing after loading it to 5.5-g with lead shot bags.

Jiran-prefab VariEze wing at 7.5-g.

AD-1 with wing straight.

AD-1 with wing at 60 degree skew.

N4EZ VariEze, N78RA Defiant, N27MS VariViggen.

Dear RAF,
We have over 280 hours on our airplane, and everywhere we travel people are very pleased and excited with your Eze design because we are generally very satisfied with it especially since we took the toe in out.

We have over 50 hour flying time with other Ezes, Ed and Jo Ann Hamlin, John and Wilma Melville, Les and Olga Faus, and Bruce and Bonnie Tifft. And we have all talked about organizing a VariEze club. So enclosed is a copy of our club's information, and you know, of course, that we would be very much appreciative if you would please print it for us in the newsletter soon. Please let us know if there is any cost.
Thank you, Very sincerely yours,
Donald Shupe.

VARIEZE HOSPITALITY CLUB
Non profit organization to put VariEze pilots in touch with other pilots or builders who would like to share their homes for one or two nights with travelling VariEzers. The idea is to increase communication and friendship between VariEzers and to provide an alternative to expensive motels and car rentals. In addition, we will hopefully have people who could help with parts and repair when needed within a hundred miles or so of every airport. If interested, please send a check of $2. with a clearly printed 3 x 5 card to Dr. Donald Shupe, 2531 College Lane, La Verne Ca 91750, phone (714) 593-1197.

Last name First name Date
Address, state and town Telephone
Airplane #, hours on it or % complete
Number of people you are willing and able
to accommodate at one time.
Most convenient hours to contact you
Other conditions: (and valuable information such as - airport hangared, other close airports, condition of runway and length of runway).

People sending names must understand that we cannot guarantee that other respondents will accept you as overnight guests, but our experiences (76WN, 777EJ, 39EZ) have been very rewarding. Those who send names will receive all information on all respondents.

VARIVIGGEN OR VARIEZE

Wiring of com. radio to allow a headset and a simple, single-pole push-to-talk button. All hardware shown is available at Aircraft Spruce or Wicks. **SKETCH OMITTED**

CARTOON OMITTED

CP20, Page 11

VariEze

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE. The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $3500 (less engine) in about 1200 man-hours or from prefab parts and materials, costing approximately $5000 in about 800 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect, and repair. The VariEze uses the small four cylinder Continental. The Lycoming 0-235 without starter or alternator can also be used. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 22 gallons of fuel. Frontseat passengers up to 6'4" and 220 lb and backseat passengers up to 6'2" and 220 lb. can be accommodated plus a modest amount of baggage in a suitcase. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE TEST PROGRAM. The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin

and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/ components, manufacturing methods testing, and many other.

THE HOMEBUILDER SUPPORT. The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter published quarterly. One-year subscription	$4.75	$6.50
Section I	$139.00	$153.00
Section IIA	$19.00	$21.00
Section IIC	$21.50	$23.50
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95

Add 6% Calif resident - newsletter is not taxable.
*U.S. FUNDS ONLY

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound 11" x 17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, C85, C90, 0-200
SECTION IIC - Lycoming 0-235 - No accessories.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/ color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS AND PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP @ GROSS WEIGHT

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	570 lb
Gross Weight	1050 lb
Range @ Max Cruise	700 mi
Range @ Econ Cruise	850 mi
Landing Speed	70 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6' square feet
Canard Span/Area	12.5'/13' square feet

SPECS AND PERFORMANCE WITH 75-HP CONTINENTAL

Take Off	1200 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	550 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS

ALL RAW MATERIALS

AIRCRAFT SPRUCE & SPECIALTY CO
201 W. Truslow Ave. Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $3

WICKS AIRCRAFT SUPPLY
410 Pine,
Highland, Il 62249
(618) 654-7447
Catalog $2

KEN BROCK MANUFACTURING, 11852 Western Ave. Stanton, Ca 90680 (714) 898-4366: Prefabricated components - wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, 6 Mojave Airport, Mojave Ca 93501, (805) 824-4558: Prefabricated components, cowling, fuel tanks, wheel pants, maingear & nosegear struts, strut cover & nosegear box. Send 9"x12" SASE with 4-oz postage for brochure

THE AIRPLANE FACTORY, 7111A Brandtvista, Dayton, Oh 45424 (513) 845-9872 or 233-7754 - Canopy. Send SASE

H.C. COMMUNICATIONS, Box 2047, Canoga Park, Ca 91306
(213) 882-0422. Custom COM & NAV VHF antennas.

VARIVIGGEN

PHOTO OF STANDARD VARIVIGGEN AND SPECIAL-WING VARIVIGGEN OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take Off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft Stick	49 mph
	Landing	500 ft
Performance with 150-hp. Special Performance Wing	Climb	1000 fpm
	Cruise	158 mph
Specifications Standard VariViggen	Canard Span/Area	8ft/18.3 square ft
	Wing Span/Area	19ft/119 square ft
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications Special Performance Wing	Wing Span Area	23.7ft/125 square ft
	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh 72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA SAE, AOPA, AND AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43kts) it will still climb 500 fpm roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73 and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips". Gas service and other airport services have been better too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION.
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS.

AIRCRAFT SPRUCE & SPECIALTY CO. 201 W. Truslow Box 424, Fullerton, Ca 92632 (714) 870-7551
VariViggen spruce kit, plywood kit, hardware, all aluminum and fiberglass. Catalog cost $3.

KEN BROCK MFG. 11852 Western Ave., Stanton, Ca 90680. (714) 898-4366.
VariViggen prefabricated components: all machined parts. Catalog costs $2.

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave., Dayton, Ohio 45424. (513) 845-9872
VariViggen plexiglass canopy

BILL CAMPBELL Box 253 Phelan, Ca 92371
VariViggen brackets and fittings.

MONNETT EXPERIMENTAL AIRCRAFT INC., 955 Grace St Elgin, Ill 60120 (312) 741-2223
VariViggen molded fiberglass parts.

GOUGEON BROTHERS, 706 Martin, Bay City, Mi 48707
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS 4102 Twining, Riverside, Ca 92509
VariViggen welded nose and main landing gear. 1-1/4" sq. steel tube.

JESSE WRIGHT (VariViggen builder) 7221 S. Colorado Ct. Littleton, Co 80122 (303) 771-5140
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8" x 10" glossy photo and current issue of newsletter. Price - $10.00 first class mail, $11.50 Air Mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook i including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price - $6.00 first class mail, $7.50 Air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas,

improvements, building tips, photographs, and flight reports as possible. Details mandatory, desirable, and optional changes to plans and to owners manual. A newsletter subscription and back issues starting with CP#19 are mandatory for those with VariViggen under construction. Identifies new material sources as they become known. Published quarterly. Price - $4.75 per year first class mail. $6.50 per year air mail overseas. Back issues, $1.00 ea.

VARIVIGGEN PLANS - SECOND EDITION. This is an updated, revised set of very complete drawings and construction manual consisting of a bound 11" x 17" book, containing many photographs, hints and instructions based on actual builders experience over the part several years. It covers the entire airplane, including the engine installation fuel system, and not only covers the original standard wing in both aluminum and foam an fiberglass composite, but it also includes the composite S.P. wing, ailerons, and rudders. The manual identifies sources for all required materials and all available prefabricated parts and components. Price - $165.00 first class mail, $177.00 Airmail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18% - size radio controlled model airplane built and flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment and engine in the .35 to .65 cu inch size. 555-sq wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines) Price - $475 first class mail, $5.50 air mail overseas.

THE CANARD PUSHER NO 21 JULY 79

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Overseas (AIRMAIL) - $6.50
Back Issues - $1.00 each

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 21. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 21. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 21. If you are building a VariEze from the 2nd Edition plans you must have newsletter 16 through 21. A current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 9:00 to 12:00 and 2:00 to 5:00 on Wednesday through Saturday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins. Our building will be closed 26 July to 9 August during Oshkosh convention.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions" This will speed your reply.

CONGRATULATIONS! There have been a very large number of first-flights of VariEze's since April, averaging about one every three days. The following list is of VariEzes' first flights that RAF has been notified of since our April newsletter.

Eric Larson	San Diego,	Ca
Lou Mason	San Antonio,	Tx
Tom Franken	Great Fall	Mont.
Jim Davis	Falls Church	Va
John Neils	Bozeman	Mont
Bob Ohletz	Thousand Oaks	Ca
Norm Ross	Victoria	Canada
Bob Purdy	Carbondale	Ill
Ray & David Ganzer	El Cajon	Ca
John Wagner	Pontiac	Mi

Canard Pushers from 1 to 82

H.A. Bowman	Anchorage	Als
Ike Griswald	Phoenix	Az
George Gilman/		
Otto Schimmel	Santa Paula	Ca
Harold Heiman	Aurora	Ill
Carlos Amspoker	Martinis	Ca
Robert Vaughan	Nashville	Tn
Mel Blanchard	Independence	Or
Bob Mudd	Albuquerque	N.M.
Chet Ellingston	Huntington Bc	Ca
Bruce McKinney	Belmont	Ca
Dick Davey	Boise	Id
Riley/Walkton/Beenson	Swickley	Pa
Ben Duarte	Dallas	Tx
Loyd & June Foster	Mt Shasta	Ca
Don Youngs	Palo Alto	Ca
S. Cochran	Swanton	Oh
Jack Day	Reading	Ca
Dan Laurence	Hopwell	Va
Bob Wahrmund	Austin	Tx
Mick Hinton	Kororo via Coffs Australia	

This totals of 126 VariEzes that we have heard of that have flown. Now, if we all arrive at Oshkosh Saturday in formation - - - - - -!!

RAF ACTIVITY Since the April newsletter has included builder support, development and test of the Long-EZ, and refining our Defiant - VariViggen - VariEze airshow routine. Also, we have run a complete series of workability tests with SAFE-T-POXY, the new epoxy that now allows sensitized people to hand laminate.

OSHKOSH 79 should be a big year for the canards. We expect that 25 to 50 VariEzes, VariViggens and Quickies will fly in to the EAA convention July 28 to August 5. We will attempt to reserve two rows immediately north of the access road so we can all park together. We plan to organize a daily pilot's bull-session at the airplanes. Here's the RAF forum schedule:

VariEze	1 Aug	3pm
VariViggen	3 Aug	3pm
Defiant	2 Aug	1:30 pm
Quickie Design	31 Jul	3 pm
College	2 Aug	10:30 am

Tentative schedule for RAF Airshow - (Defiant/VariViggen EZ formation)

Sunday	29 July
Tuesday	31 July
Thursday	2 August
Saturday	4 August

GOOD NEWS! BREAKTHROUGH IN EPOXY
The new low toxicity epoxy from Applied Plastics, is now approved for release to our raw material suppliers, Wicks and Aircraft Spruce. The epoxy is called SAFE-T-POXY, which is a registered trade name. RAF has

done a considerable amount of testing of this material, and have found it to be as good or better in all respects as the RAEF and RAES and you will no longer have to worry about which to use. Safe-T-Poxy does not exotherm, and can therefore be used in both large and small lay ups with low danger of heat/foam damage.

Response from those builders testing Safe-T-Poxy has been 100% positive, even though the samples were not as easy to work with from a "thickness" standpoint.

We are very pleased with this development, and proud to have been associated with Applied Plastics, in this milestone in epoxy development. Results of one of the test follows:

Attention: Mr. Burt Rutan Subject:
SP-10 Epoxy Tests.

The Applied Plastics Co. sent samples of the new, low toxicity, epoxy system for home tests. The results of my test are listed on the attached page. In summary, there were no detectable toxic effects whatsoever.

Thank you for developing this new epoxy system, it is another significant contribution to the aircraft industry.

Sincerely
Paul J. Bryant
Prof. of Physics and
Lecturer in Medicine.

SENSITIVITY DATA RECORDED FOR TWO EPOXY SYSTEMS RAE & SP-10

Parts of body effected	Symptoms. RAE	SP-10	Duration of effect RAE	SP-10
Back of hands & wrists	dermatitis rash	no effect	48 hrs	none
palate and throat	soreness & reddening	no effect	7 days	none
sinuses and forehead	moderate headache	no effect	8 hrs	none
finger tips	hardened flaking	no effect	10 days	none
forearms	itching	no effect	4 hrs	none

Since the ratio of resin to hardener is different than the previous APCO epoxy, see CP20 for the necessary changes to your balance scale. If you have "Michael's Engineering" ratio pump it will need to be reconfigured before you can use it to ratio Safe-T-Poxy. See the sketch on page 9 for a simple way to do this. We have done this and have good results.

VARIEZE OPERATOR EXPERIENCE. We've been criticized by some VariEze flyers that our newsletter covers only builder support and modifications and when covering flyers we discuss only accidents or problems, but not the fun part. With this in mind, the following section summarizes' some of the information we have received concerning VariEze "social life".

First, activity from the VariEze Hospitality Club (CP #20, Page 11)

"This is the 1st Annual International VariEze Hospitality Club flyin at Mariposa. The largest assembly of VariEzes since Oshkosh 78. There were ten Ezes flew in plus two builders of nearly complete birds.

Les and Olga Faus	N14533
Ken Forrest	N84ST
Gerald Gardnor	N99EZ
Julie and Bill Lermer	N51820
Ed & Joann Hamlin	N777EJ
Ron Kaporman	N16EL
Dan & Mark Lee	N35EZ
John & Wilam Melville	N76WJ
Donald & Bernadette Shupe	N39EZ
Bruce & Bonnie Tifft	N115EZ

Everyone except three stayed with Bruce's parents, brother, and relatives for one night and had great times telling lies !!!

"Pine Mountain Lake VariEze Hospitality Club fly in over Memorial weekend. Faus, Hamlins, Melvilles, and Shupes rented a house for the weekend, and it was great! The Ezes were parked just off the Pine Mountain runway on the land of Charlie Lynn, builder of the Mini-Mustang. Pine Mountain, with runway access lots and friendly people captured the hearts of the attendees."

"We have planned another informal VariEze flyin to be held October 20-21 at Columbia, Ca. Notices with details are being mailed to all the Eze owners that we have addresses for. We need to give the airport people at Columbia some idea of how many airplanes we expect, so please get in touch with the below listed people for further details if you would like to attend. Hope to see you all at Columbia in October."

Bruce and Bonnie Tifft (805) 649-2721
Bill and Julie Lermer (714) 462-0904
Hotels: Columbia Inn (209) 532-7357
Stagecoach (209) 532-4508
City Hotel (209) 532-1479
Campground at edge of airport also.

Ray and Nova Cullen recently visited RAF in Mojave in their newly completed and very beautiful VariEze. They did a super job on their EZ and are both concerned about builders who are having difficulty with their projects. They have expressed a sincere desire to assist other EZ builders in their area. Call (503) 842-5440 or write

Ray and Nova Cullen
1116 6th Street,

Tillamook Oregon 97141
Thanks Ray and Nova, this local help is extremely important to builders needing assistance.

FLASH! Peter Kraus flew his VariEze at the Paris Airshow, in an impressively smooth, low level, aerobatic display!

We understand that Johnny Murphy, builder of VariEze N20VE has, together with his brother, built and flown a Quickie. That makes two E-Z builders who have completed and flown a Quickie. We hear that he was just elected Mayor of his hometown, Cape Canaveral, Florida. Congratulations, Johnny !!

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Mariposa.

Pine Mt. Lake.

Ray & Nova Cullen.

Lee & Dianne's Trio.

Norm Ross' EZ - 1st in Canada.

A. Hinton's EZ.

Lee and Dianne Herron own a unique set of three airplanes - see photo. They were the first homebuilders to fly off restrictions on a VariEze in 1977. They were the first homebuilders to fly a Quickie. Their VariEze cruises at 190 mph on 100 hp. Their Quickie and Cessna both cruise at 125 mph on 19 and 100 hp respectively! Their Quickie's takeoff distance and cruise speeds are better than the Quickie manual performance figures. Lee and Dianne built their Quickie in 111 days and 525 manhours.

Note: Address any Quickie correspondence to Quickie, not RAF. Quickie, Bld 68 Mojave Airport, Mojave Ca 93501 (805) 824-4313

A. Hinton
RMB 13 Woolgoola Rd
Kororo Via Coffs Harbour
N.S.W. Australia

Dear Burt,

I would like to inform you that my VariEze VH-EZH is now flying (fantastic to say the least). It weighed out just under 600 lbs with alternator and limited I.F.R. panel.

Thank you very much for your help, which has allowed me to build this magnificent machine. It flies hands off and I just can't stall it, but will be going back into the work shop soon to install the wing cuffs.

After the necessary flight tests in March of this year, I was able then, accompanied by my wife to do my longest flight in EZH and enter my EZ in the SAAA convention of the year at Bowral N.S.W. I am very proud to say it won the Reserve Grand Champion home built of Australia. This was my first attempt at building so mere words will never express how I felt that day.

Since the air show my phone has rang constantly with inquiries from future builders of the VariEze.

Hope to see you at Oshkosh this year.

Yours faithfully,
Mick Hinton.

The Photo on pg 2 shows Norm Ross' beautiful new VariEze. It weighs 603 lb, yet has full electrical system, I.F.R. panel and leather upholstery - it is the first Canadian EZ to fly.

Some comments from Dr. Jim Wright, Kansas City. "I have noticed an early tendency on the part of everyone flying 26JW to have the right wing drop momentarily on lift-off, even with the two TWA pilots, and talking with them I believe its related to our tendency to want to keep the stick vertical rather than canted to the left. We all have a lot of stick time and maybe just keep it "in the middle" by habit. When we have thought about that and remembered not to "force" the stick to be vertical the wing does not drop. I've made a couple of cross country flights, and on one short one, KC to Jefferson City, Mo., I got a ground speed of exactly 200 mph, checked out by time and crossing the departure field at altitude and checking time as I crossed the Jefferson City airport at same altitude. I took one trip KC to Houston Tx., Port Arthur, back to Houston, Fort Worth, and back to KC. Put 14 hours on 26 JW and used 64 gallons. That's 4.57 gals/hr! I cruised at from 8,000 to 11,500 at about 65 to 70% power, but also did a lot of take offs and landing joy riding friends. I used one quart of oil on the trip! I'm pleased with and proud of 26JW, and thank you for a good design and fine support program. When a VariEze pilot goes into a new airport he is, indeed, a celebrity and all the hard work to get a well built aircraft is worth it. And I suggest to all who are about to buy a prop and want a really good performer at reasonable price that they talk to Ray Hegy."

More from Nat Puffer, Minneapolis, who owns one of the cleanest EZ's around. His 85hp Ez is faster than most of the 100 hp ones. "Don Rosborough, VariEze builder from Philadelphia, stopped in and I took him flying. After letting him fly from the back seat, and doing wing overs, the air was smooth so we opened it up at 4000ft. We hit 175 mph indicated which we calculated was 188 TAS at a density altitude of 5000. That looks like about three mph better than your curve for a C-85, and translates to 195 mph sea level. There are still a few things I can do yet to squeeze a few more mph out:
1) Aileron gap seals
2) Seal the large trim gap on my rudder, which I don't use.
3) Herb Sanders trailing edge exhaust pipes. I would like to say some day that I have a 85 hp, 200mph airplane!"

PHOTOS OF EZ N4EZ AND LONG-EZ N79RA OMITTED

N79RA - LONG-EZ. The Long-EZ equipped with Fred Jiran's prefab wings made its first flight on June 13th, 1979, and is in the middle of a rigorous flight test program at this time. We have put 30 plus flight hours on it to date.

The design goal for the Long-EZ is a comfortable, two place, cross country airplane, with long range and the capability of carrying a starter and alternator on the 0-200 or 0-235 without the penalty of lead ballast in the nose. Of course, having a larger whetted area and being heavier it is not as fast nor as spritely as a standard VariEze. This aircraft was designed for those people who insist on having starter, alternator and full electrical. The Long-EZ has longer range, more wing area and wider fuselage than a VariEze. It sports a nose rudder using conventional rudder pedals and toe brakes.

This is all the information we have to release at this time and we would appreciate it if you builders interested in Long-EZ please wait until our test program is complete. As you know, our policy here at RAF, is that until we are ready to sell anything, we will not encourage anyone's interest, until we have a marketable product.

If the Long-EZ completes a successful test program we will market a Section VII. (Long-EZ addendum). You will be able to use your VariEze plans. The canard, elevators, wings and cowling are the same as a VariEze. Do not assume that the Long-EZ will be available. It's acceptability depends on the success of the remainder of a very thorough test program. If successful, the Long-EZ addendum will be available this winter. Look for an update this October in CP#22.

ROTORWAY RW-100/VARIEZE UPDATE We still have not begun any formal RW-100/VariEze compatibility testing. We have received no information from Rotorway that the developmental deficiencies we consider necessary to begin testing (stated in CP #20) have been corrected. Again, we must caution our builders that until the deficiencies have been corrected and an acceptable testing of reliability and performance has been established, we will be unable to ascertain the acceptability of the RW-100 or any other alternate engine for the VariEze.

IMPROVEMENTS/CHANGES - MANDATORY?
Modifications, improvements, and changes in our newsletters have not been specifically tagged as to their mandatory nature. These recommendations have, instead, been verbalized in the description accompanying the change.

We at RAF, of course, can not enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety. We are therefore listing past and future changes in several categories.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.

Note that changes correcting plans errors are not listed. Only those that could be interpreted as flight safety items are listed. Read all your newsletters, this is not a complete list.

Be sure you check the following list against the current status of your aircraft.

VARIVIGGEN

Category	CP#	Change & Page
DES	1-2 + 21-8	Trim tabs on Viggen elevators
DES	2-2	Reflex Thd double advance
MAN-10HR	2-2	Remove upper O-ring
DES	3-6	Modify fork
MAN-GRD	4-4	3/32 cable
MAN-GRD	4-4	Stiffen SA5
MAN-GRD	6-8	Emergency gear extension
MAN-GRD	9-7	Fuel plumbing
MAN-GRD	12-11	Reflex for first flight
DES	14-12	Shorten FP-3
MAN-10HR	15-11 &	Cowl screen - see construction manual part II
MAN-GRD	17-6	Canopy safety catch
DES	16-10	Worm drive main gear - MAN for new aircraft construction

MAN-25HR	21-7	Skin reinforcement
VARIEZE		
Category	CP#	Change & Page
MAN-GRD	10-6	Fuel tank drains
MAN-GRD	11-5	3-tank fuel system
MAN-GRD	11-7	UND wrap on C/S spar
OBS	11-A1	Spoilers - obsoleted in CP12
MAN-GRD	12-9	1.7" dim on tab
MAN-GRD	12-18	Replace elevons with ailerons, remove spoilers (see CP13-2)
MAN-GRD	14-6	All-glass maingear tabs
MAN-GRD	14-6	Shorten Canard - New cg ranges (if cg requires)
MAN-GRD	14-8	Drill hole in inlet hose
MAN-GRD	15-2	25-hour interval on fuel filter inspection.
MAN-GRD	15-2	First flights only - strip all unnecessary weight out before first flight
MAN-GRD	16-4	Contour canard within 0.006
MAN-25HR	16-5	NG25 or new-design NG15A (CP 18 pg 4)
MAN-25HR	16-6	Inserts in brake Nylaflow low fittings
MAN-GRD	16-9	Safety cables on short stacks see also CP18
MAN-GRD	17-5	Wide-chord elevator. DES or OPT if you are already proficient in flying your narrow-chord EZ. MAN for new aircraft
MAN-GRD	17-6	Canopy safety catch
MAN-GRD	17-4	Replace valve if stiff
MAN-25HR	18-5	Gascolator and fire resistant fuel lines.
MAN-25HR	19-3	Worm-drive nosegear. MAN-GRD for new construction

MAN-25HR	19-2	Wing cuffs. Also, limit cg as shown until cuffs are installed
MAN-GRD	19-4	Rebuild elevators if more than .3 lb required to meet balance angle. 1/2 Additional weight must go at tip balance area.
MAN	20-3	UND Beef on main gear. MAN for new construction, and on operational aircraft if gear creep is experienced.
MAN-GRD	20-4	1/4" rod ends in pitch system.

Sally, shutting down after her first solo flight in Viggen N27MS. Mike, ready for a kiss! **PHOTO OMITTED**

VARIEZE PLANS CHANGES

Section IV pg 30	delete "light grease on nosegear guides" and change to "light grease on worm and wormgear".
Section IV pg 37	add "before first flight, clean and flush all screens, both carb and gascolator. Remove and clean out carb float bowl and finger strainer.
Clarification to C.P. #19 pg 7.	When retrofitting the crankdown nose gear system, Discard: Reuse: NG 13 NG 9 NG 11 NG 10 (cut down) NG 12 NG 14
Section IIC pg 36	Fuel system shown is obsolete Follow page 7,10,11, & 17
Section IIC pg 27	Material for throttle and mixture controls is .062 2024T3 aluminum Also, see Pg 9.
Section I	Construction Order. Build fuselage first and canard and elevators last.

The reason for this change is simply that the canard and elevators is the most important and critical part as far as accuracy is concerned, on the whole airplane. Rather than learning to use the materials while building such important parts, we want you to learn to handle the foam and fiberglass-epoxy while building such simple parts, as fuselage bulkheads, seat backs and fuselage sides. Then work your way into assembling the fuselage and making the bottom. Follow the plans from here, and finally last of all, build the canard and then the elevators. By this time you will be thoroughly proficient and should be able to make excellent parts.

ELEVATOR BALANCE (continued) Here we go again!
It may seem that we harp on about the elevator shape and balance, but the fact remains that the single most important parts of the airplane are the elevators. Recently, since CP20, we have had yet another builder who experienced elevator flutter. It occurred at 120-130 mph and produced such a violent shaking, that he was certain the airplane was going to come apart. It turned out that he had extended his elevator's trailing edge and found he had to add weight. Unfortunately he added considerable weight only to the inboard, and none to the outboard counter weight. This is a NO NO!! It is critical that any extra weight added to balance the elevators to 10 degrees - 20 degrees nose down (up to a maximum of .3 lb) be equally divided between the inboard and outboard. Keep your elevators light! In his case, these elevators weighed around 5 lb a piece, which is totally unacceptable. If yours are over 3.9 (lt) or 3.6 (rt) balanced, strip them to bare tubes and start over.

While we are on the subject of balance I want to clarify the method of measuring the 10 degrees - 20 degrees nose down angle. A few builders have been using the flat bottom of the elevator, which is wrong.
SKETCH OMITTED

INITIAL FLIGHT TEST
As new VariEzes emerge from their concealed assorted construction sites and start taking to the air for the first time, the great majority of the pilots report no problems, "the aircraft flew great, just like the book". However, a few are still having control problems during initial flights. When we investigate the problems we often find a pilot who is neither current, proficient, familiar enough with the VariEze owners manual, or does not understand that a VariEze does not fly like a Cessna 150 or some other sluggish trainer. The VariEze is high performance, responsive aircraft with differences. It has a side stick and the pilot should keep his forearm on the arm rest and use his wrist to control pitch. Also, the rudders can both be inadvertently deployed at the same time and the pilot should be careful not to do this in flight. Jim Davis got a little tense and unknowingly pushed both rudders simultaneously giving him yaw-roll problems. (see his story below). Another pilot reported very poor climb and he said he almost hit a small hill on his first take off. I was concerned until I found out he was holding 130 mph, thats 38 mph above best climb speed, no wonder the climb rate was low. The nose and canard attitude gave him the impression he was climbing when he wasn't. I flew first flights on two new VariEzes here at Mojave. Both aircraft flew normally, but both pilots had problems when they first flew on their own. One pilot rounded out high, got real slow on landing and hit the winglets on "crunch-down". The other pilot had pitch control problems (PIO) and damaged the nose gear. He was trying to fly with his whole arm instead of just the wrist.

Lets discuss the three common areas that seem to give a few people problems.

1. The non-standard rudder pedals. Beware not to push both at the same time in flight. One will usually be out more than the other producing unwanted yaw. The VariEze rudders are very effective and the yaw generated couples easily to roll. In fact the roll rate will

almost double with rudder added to aileron control. Adjust the pedals so your foot does not press the pedals naturally.

2. Pitch over-controlling. The novice pilot will expect the VariEze to handle like the C-150, or what ever, he last flew. The experienced pilot knows that J-3 cubs and Bonanzas handle different and will make the transition easily. Spend enough time on the runway just above rotation speed but below lift-off speed and practice controlling pitch so you can put and hold the desired/selected pitch proficiently. Hold the forearm on the arm rest and control pitch with wrist only. Do not over-rotate! The highest rotation you should see during this or the later flights is the canard up to, but never above the horizon. Better yet, keep it always at least 2 degrees below the horizon.

3. Nose high, Slow touch down speeds. To avoid this be sure that during take off and landing to not rotate the nose above the horizon. On take off rotate the nose/canard to just below the horizon. Hold it there and wait for lift off. On landing, fly final and touch down while you can still easily see over the nose. If you cannot see the runway, go around and use more speed next time. You will find that using this technique you will be a little above the minimum touch down speeds. This is okay to be a little fast for your first few landings. Runway length notwithstanding a hot landing in a VariEze is no problem and is much better than a slow, wing rocking, blind "arrival".

The following is from Jim Davis' about his first flight experience: "On first flight, I experienced unusual roll on climb out and level flight. This occurred unexpectedly, both right and left at a random rate. First landing was exceedingly hard and resulted in damage to the main gear, wings, etc. I believe this was due entirely to pressing on the rudder bars inadvertently. I had flown back seat of another VariEze and experienced the unusual sensitivity of the controls. However, this didn't carry over well to the rudders which I had been tromping on for brakes during two hours of high speed taxiing. Rudder cable length was short, cut to insure solid brakes with toes down. Seat cushions, adjusted to other Rutan criteria definitely accentuated the problem. I didn't

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realize the unusual roll induced in swept wings by rudder action.

Suggestion: Make sure your rudder cables are long enough to keep foot pressure off rudder bars without any effort. Make every effort to ride the backseat of another VariEze before first flight in yours. Fly dual in a Thorpe T-18 or other small plane with very sensitive controls and speed on final of 80 mph. There is really no substitute for this experience - and keep your feet off your rudder bars unless you want yaw and plenty of roll."
Jim Davis, Falls Church, Va

Another area we need to emphasize is weight. During the initial flight testing "KEEP IT LIGHT". Our philosophy is "if it isn't needed for first flight don't put it in". Give your aircraft every chance of successfully completing the test phase. If you keep the weight out of the tail (gen/alt/starter/pump etc) you don't have to ballast the nose

as much to get the cg into the "first flight box". Remember the aft cg limit might not be the same for your aircraft as it is on N4EZ due to builder differences. Be careful, work toward the aft cg limit gradually.

Another question is "why wear a parachute during flight test"? Will I hit the prop or the canopy or should I slow up and roll inverted - - - ? Remember your aircraft may not fly like N4EZ or a builder error could cause destructive flutter or a loose fuel line could cause a fire, or many other things. In any of these cases the parachute is the only means of survival. As for how to bail out - - - you open the canopy unfasten the belt and jump over the side. Don't worry about the prop, you will fall away from the aircraft long before you get blown back into the prop. You need 250+kt before prop contact should be a factor. Remember if you find yourself in a situation where staying with a stricken aircraft means death and the parachute is a chance to live, I think I would take that chance no matter what the odds were. It sure is comforting to have a chute on your back to get home with in the remote chance the aircraft came apart. As a two time member of the Caterpillar Club, I recommend parachutes enthusiastically. (Above comments by Dick Rutan)

ACCIDENT Fuel contamination: Steve Stuff had an engine failure just after take off and damaged his VariEze running off the end of the runway. The failure was due to debris in the carb float bowl blocking the main fuel jet. Therefore, we are changing Section IV to clean the screens and the float bowl after the engine/taxi runs but just prior to first flight. Note that Section IV already requires a 25 hour inspection and cleaning of the gascolator.

Did you know: that a Boeing 727 can run over you (midair) and not ever see you? Reference Aviation Week report on the San Diego midair-they found that when the airline crew is in their usual sitting position (slightly down or back from the recommended position) it is possible to run into you and never see you, even if they are looking, because the windshield wipers will obscure you from their view. "You all be careful now."

BUILDERS HINTS Bob Lokey, of Universal City, Texas, recommends the following method of repairing a bad gouge in blue foam. Use a 1 7/8" dia hole saw with the guide drill bit removed, and turn it by hand centered over the damage until about 1/2" deep. Remove the center `plug' with a chisel. Now use a 2" dia hole saw with guide drill bit removed, and cut a plug from some scrap foam. Paint a little slurry on the bottom of the 2" plug, and "screw" it into the hole made by the 1 7/8" dia hole saw, until it firmly bottoms out. Use a hard sanding block to sand it down flush. Bob says it works beautifully. Don't neglect to use slurry to glue the plug in, though, a plug, just forced in dry is not structurally acceptable. If you need to hot wire through the plugged area, leave out the slurry until after hot wiring is complete, then slurry and nail the piece in place until cured.

Several builders have purchased the CD1145 worm gear from Boston, and have received a webbed cast gear with lightning holes in the web. This gear can be used if you follow this procedure: Remove all grease, and sand blast or sand with 60 grit, the webbed area. Lay the gear down on some Saran wrap on a flat surface. Now mix up some flox and trowel it

into the lightening holes making sure to get good squeeze out, and thoroughly fill all voids. Trowel off excess, level with the gear and allow to harden. Now drill and countersink 4 #12 holes for AN509 bolts and bolt to NG steel weldment. This system works great, we have it on N4EZ with no problems. Viggen builders can use the same method in the worm-wormgear main gear system as it uses the same Boston gear.
SKETCH OMITTED

FEATHERFILL some builders have not read their newsletters and are still experiencing problems with feather fill. This newsletter bulletin supersedes all previous instructions including Section V on Finishing. Before attempting to apply featherfill - surface must be dry, dull and clean! A "fog" or "tack" coat (very light coat) of featherfill should be sprayed or brushed on and allowed to "tack" up for 10 - 20 minutes. Now mix up a batch of featherfill (must be thoroughly mixed using a paddle or wire in a drill press) and mix 25% - 50% micro balloons by volume into the featherfill. Use a 2" brush, and brush it all over the part you are working on. Allow this to cure thoroughly, then dry sand using new 100 grit and a spline. As soon as you see glass high spots quit! Again brush on featherfill - micro balloons in any remaining low places, allow to cure and sand with 100 grit and spline. Generally these two applications as described above will be sufficient for all but the worst surface, three applications at the most. You should use 1 1/2 gallons at the most on a VariEze.

Some people have had problems with their Rosenhan brake discs. Mr. Rosenhan is selling an excellent replacement disc direct from him for $10 each.

Note that the styrofoam referred to in the plans as blue foam is not as blue as it once was, in fact some builders have reported receiving almost white foam. This is ok, just be sure it is styrofoam, which it will be if you purchase it from one of our designated suppliers Wicks or Aircraft Spruce.

The speckled paint finish as seen inside Fred Keller's cockpit at Oshkosh last year, is "Zoletone" which is available from most paint supplies, one of which is Paramount Paints, Westminster, Ca.

Joe Deady reports that he has been using a pair of ski goggles when sanding or grinding with excellent results. The soft foam seal is designed to keep out fine particles like snow and conforms to your face, even with a dust mask on, and it stays completely fog free.

Installing Jiran Fuel Tanks. The fuel tank bottoms are pretty straight forward, but don't forget to remove the peel ply!! Then paint a generous coat of pure epoxy all over the inner surface of the tank. Do this with the tanks at the same temperature as the shop. (Don't bring them into a cool construction environment, after they have been stored in a hot shed, or vice-versa).

When you get ready to put the Jiran fuel tank tops in place, do not build a small "ledge" along the fuselage as shown for the home built tanks. Cut a 3" wide strip of BID at 45 degrees and lay it up on the edge of the tank top, lapping onto the tank 1 1/2". Be careful not to wet the 1 1/2" overhanging half of the BID tape. Allow this to cure for three hours, then install the tank top with flox and tapes, and wet

out the BID tape onto the fuselage as shown. After this cures, trowel dry micro into any gap between the tank and fuselage and apply two BID tapes over this joint lapping equally onto the tank and fuselage. **SKETCH OMITTED**

When making your main landing gear attachment tabs, in Section I chapter 18, you are told to lay up your pads on a `piece of paper', do NOT use waxed paper in this application, as it is possible for the epoxy to pick up wax, and then to have in effect a wax barrier between the tabs and the gear leg.

Caution Do not ever hand prop a VariEze (or any airplane) that does not have at least one functioning impulse mag. An impulse mag allows the plugs to fire at or slightly after top dead center, without an impulse mag it will fire up to 25 degrees before top dead center, which can lead to broken thumbs at the very least. If you only have one impulse mag, be sure you select only that one until the engine is running.

Safety Hint. This suggestion comes from Lee Herron. "It has been pointed out by the F.A.A. Eastern Region E.M.D.O. that the canopies of the bubble-type found on VariEze, Quickie, KR-2 etc., are impossible to break or open with the bear hands in an emergency and not all emergency personnel know to freeze the Lucite canopy with Carbon Dioxide before it will break. Therefore, an emergency canopy opening system is desirable.

An acceptable answer was found when using MS20001 type hinge, the hinge pin is replaced with 1/8" stainless music wire that has a one inch finger loop at the front end. A 1/8" hole is then drilled into the base side of the hinge and the wire loop end snaps into this hold and locks the pin in place until pulled to release the canopy in an emergency. To finish the job, use 3/8" red "stick-on" letters along the hinge "PULL EMERGENCY". Simple and safe. **SKETCH OMITTED**

Noel Bramich, first VariEze to fly in Australia, had tremendous overheating problems on a Rolls Royce O-200. He finally traced it to too small of a main jet. EZ builders - take note!!

Junking of non perfect parts. We have received many calls lately from builders who have a poorly built part, too heavy, dry lay up, etc. Also builders who are determined to use epoxy that has expired (Lambert). Try to put yourself in the position of a manufacturer of a certified airplane. If any parts don't meet quality control specs, or if any material is over shelf life, it is thrown out and not used. You are building an aircraft that you will trust your life to, do not use substandard parts, or expired shelf life materials. In the case of expired epoxy, use it to build a boat, remember you can swim a whole lot better than you can fly.

VARIEZE SHOPPING. Props for the VariEze are available from the following vendors. We have evaluated sample props from these suppliers and have found workmanship and performance to be excellent.

Ted's Custom Props
Ted Hendrickson
9917 Airport Way,
Snohomish, Wa 98290
(206) 568-6792

Bill Cassidy
4652 Montview Blvd.,
Denver, Co 80207
(303) 322-3423

B & T Props.
5746 Ventura Ave.,
Ventura,
Ca 93001
(805) 649-2721

Ray Hegy
Marfa,
Texas 79843
(915) 729-4249

CAUTION! When mounting Cont. 0-200 engine, do not omit the 1.5" long hose # AN 844-8-6 from each mounting bolt. See Section IIA page 13.

FOR SALE
Cowley VariEze canopy (bronze) brand new, still in the box. $175.00 F.O.B. Santa Paula, Ca Call Bill - (805) 985-6565

Ted's Prop for Cont. A80 (58 x 52)
Prop Extension for Cont. A65-0.200
Call Chris Doostmard
(714) 673-9625
(714) 640-6879

Stan Cooper reports excellent results to an ad in Trade-a-plane for an engine for his VariEze. He bought a Cont. C85 for $1300 with 430 hours on it and heartily recommends going this route.

NOTE!! H.C. Communications reports that they will Not be able to fill antenna orders placed after September 1.

VARIVIGGEN NEWS
I have heard from quite a few Viggen builders since Cp20, and it seems that we will have several new Viggens flying during the summer. We only have one report of a first flight this time and that is John Poehner of Flushing Michigan. He reports excellent flying qualities and is very happy with everything but his main gear system. Congratulations John.

N27MS has flown regularly and on June 19, Sally solo'd our Viggen for the first time. She has flown it regularly from the front seat but I have never had the guts to get out and let her go solo! I finally could not put it off any longer and she went out and made three perfect landings. Sally's total flying time is 120 hours, mostly in C-150's and with a little Grumman Tiger time. The only problem is now our Viggen will not always be available for me to fly!! Congratulations Sally.

N27MS now has 298 hours total time, and for the first time we have had a minor failure. During a routine preflight I noticed a small crack in the skin under the wing attach fittings on the aft side and parallel to spar E. (see sketch) This crack was caused by torsional loads on the outboard wings, when large abrupt aileron deflection was used, i.e. abrupt rolling maneuvers.

There are two ways to prevent this: 1) on a new aircraft, before applying dacron, use three plys of UND (unidirectional) glass, layed up parallel to the butt-line over the skin crossing the ends of spar E. This should be done top and bottom on both left and right wings. On an already completed aircraft, the finish including the dacron must be removed down to bare wood. 2) The same repair may be made using a strip of 3/32" birch plywood tapered all around. Grain must be parallel to the buttline. **SKETCH OMITTED**

I carried out this repair on N27MS using 3 ply's of UND glass. The first ply was 2" wide 10" long, the second ply was 2" wide 8" long, and the third ply was 2" wide 6" long. The airplane has 15 hours on it since the repair in really turbulent air with no further sign of a problem.

An omission was made in the second edition of the VariViggen plans. The high speed fixed trim tabs, which are discussed in the technical report are not shown. They should be installed on each elevator to improve trim characteristics (speed stability). Each tab consists of a balsa wood airfoil epoxied to two booms (1/4" hardwood dowels, or fiberglass arrow shaft stock) which are epoxied into 1/4" slots notched into the trailing edge of each elevator. The booms increase the tabs effectiveness at high speed and prevent the the tabs from reducing maximum elevator lift. This allows the bungee trim system to function normally. **SKETCHES OMITTED**

VIGGEN SHOPPING
I've had several reports that the rubber shocks for the main gear are readily available through Genuine Auto Parts or NAPA. Doan #31-2014 NAPA #602-1015 made by Balkap.

Aircraft Spruce and Specialty report that they can now offer all raw materials and purchase parts required for the VariViggen main gear retract system used on N27MS.

Those of you using the worm-wormgear main gear retract system, see page 6 of this newsletter for the correct method of using the CD1145 Boston worm gear.

When building outboard wing tanks in S.P. or composite standard wings, use 9mm thick 6 lb/cu. ft. pvc (red) foam instead of urethane. Scrounge some from your buddy who is building a VariEze, or buy it from Wicks or Aircraft Spruce and Specialty.

"BIRTH CERTIFICATE" FOR FOSTER'S VARIEZE N77LF OMITTED

CARTOON OMITTED

EPOXY PUMP MOD Modification to Michael's Engineering epoxy ratio pump, to dispense 100 parts resin to 44 parts hardener for use with the new Safe-T-Poxy. See sketch and note that the linkage pivot on the

hardener piston is moved 1/2" closer to the linkage pivot on the resin piston. The original pivot is removed and extended to a position 35 inches away by bolting a length of 1" conduit to the existing handle. It is important that the entire pump assembly and the new pivot point be securely clamped or fastened to a common board or table such that there is no movement between the two. This gives nearly equal travel of both pump cylinders. Now mount a small wood block under the handle so that you limit the amount of 'stroke' on the pistons, such that they do not bind or tend to come out of their respective cylinders. **SKETCH OMITTED**

LYCOMING THROTTLE/MIXTURE SUPPORT The Long-EZ was our first experience at installing an 0-235 Lycoming, since the Section IIC was developed by AirSport. We found the throttle/mixture support in Section IIC (pg 27) to be too flexible and almost impossible to build. We redesigned it, as shown. It now is a "gasket" between the carb and engine and requires two normal gaskets (either side) when installing the carb. The small tab on the aft end should be bolted to a .063 x .6 aluminum strap. The strap is bolted to an oil pan bolt. Apply additional damping by bonding the support to the oil pan with silicone rubber sealant. The large hole in the support provides clearance for the oil drain. When rigging the throttle and mixture controls be sure the cable clamps are positioned to aim the cable directly at the actuated arm, with as little flexing as possible. The controls must work without the return springs. Check this before installing the springs. The springs provide better snub and eliminate slack. The throttle and mixture springs return to full open and full rich, should a cable fail. The throttle return spring can be attached to the firewall. **SKETCHES OMITTED**

WING AND CANARD AIRLOADS Canard Pusher No. 10 presented spanwise airloads data for the VariEze. These data are obsolete due to two changes: 1) shortened canard (142 inch) and 2) farther aft cg limit increases wing load. The data listed below is for the wing and canard at limit load factor of 5-g. Also the simultaneous 4000 in-lb winglet bending moment is applied at the wing tip. All data are for 1050 lb gross weight and worst-case cg positions. When doing any static load testing be sure to position the weights centered about the 1/4 chord position (chordwise distribution).

		WING		
Y IN	LOAD/IN	SHEAR LB	MOMENT INLB	BUTT LINE
95.95	8.489	37	4191	127.95
90.9	8.865	82	4608	122.9
85.85	9.304	129	5263	117.85
80.8	9.775	178	6167	112.8
75.75	10.261	230	7332	107.75
70.7	10.755	285	8772	102.7
65.65	11.253	341	10499	97.65
60.6	11.753	401	12525	92.6
55.55	12.254	463	14864	87.55
50.5	12.756	527	17529	82.5
45.45	13.258	594	20531	77.45
40.4	13.76	664	23885	72.4
35.35	14.261	736	27602	67.35
30.3	14.763	810	31696	62.3
25.25	15.265	887	36179	57.25

20.2	15.767	967	41064	52.2	
15.15	16.269	1049	46364	47.15	
10.1	16.771	1134	52091	42.1	
5.05	17.273	1221	58259	37.05	
0	17.775	1311	64881	32	Wingfitting

CANARD

BUTT-LINE Y IN	LOAD/IN	SHEAR LB	MOMENT INLB	
63.65	11.978	40	134	
60.3	11.978	80	403	
56.95	11.978	120	806	
53.6	11.978	160	1344	
50.25	11.978	200	2016	
46.9	11.978	240	2822	
43.55	11.978	280	3763	
40.2	11.978	321	4839	
36.85	11.978	361	6048	
33.5	11.978	401	7393	
30.15	11.978	441	8871	
26.8	11.978	481	10484	
23.45	11.978	521	12232	
20.1	11.978	561	14113	
16.75	11.978	601	16130	
13.4	11.978	642	18280	
10.05	11.978	682	20566	
6.7	11.978	722	22985	Lift Tabs

PHOTOS OF LONG-EZ OMITTED

CP21, Page 9

VariEze

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE. The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $3500 (less engine) in about 1200 man-hours or from prefab parts and materials, costing approximately $5000 in about 800 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect, and repair. The VariEze uses the small four cylinder Continental. The Lycoming 0-235 without starter or alternator can also be used. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 22 gallons of fuel. Frontseat passengers up to 6'4" and 220 lb and backseat passengers up to 6'2" and 220 lb. can be accommodated plus a modest

amount of baggage in a suitcase. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE TEST PROGRAM. The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/ components, manufacturing methods testing, and many other.

THE HOMEBUILDER SUPPORT. The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter published quarterly. One-year subscription	$4.75	$6.50
Section I	$139.00	$153.00
Section IIA	$19.00	$21.00
Section IIC	$21.50	$23.50
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95
Add 6% Calif resident - newsletter is not		

taxable.
*U.S. FUNDS ONLY

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound 11" x 17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, C85, C90, 0-200
SECTION IIC - Lycoming 0-235 - No accessories.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/ color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS AND PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP @ GROSS WEIGHT

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	570 lb
Gross Weight	1050 lb
Range @ Max Cruise	700 mi
Range @ Econ Cruise	850 mi
Landing Speed	70 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6' square feet
Canard Span/Area	12.5'/13' square feet

SPECS AND PERFORMANCE WITH 75-HP CONTINENTAL

Take Off	1200 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	550 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS

ALL RAW MATERIALS

AIRCRAFT SPRUCE & SPECIALTY CO
201 W. Truslow Ave. Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $3

WICKS AIRCRAFT SUPPLY
410 Pine,
Highland, Il 62249
(618) 654-7447
Catalog $2

KEN BROCK MANUFACTURING, 11852 Western Ave. Stanton, Ca 90680 (714) 898-4366: Prefabricated components - wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

FRED JIRAN GLIDER REPAIR, 6 Mojave Airport, Mojave Ca 93501, (805) 824-4558: Prefabricated components, cowling, fuel tanks, wheel pants, maingear & nosegear struts, strut cover & nosegear box. Send 9"x12" SASE with 4-oz postage for brochure

THE AIRPLANE FACTORY, 7111A Brandtvista, Dayton, Oh 45424 (513) 845-9872 or 233-7754 - Canopy. Send SASE

H.C. COMMUNICATIONS, Box 2047, Canoga Park, Ca 91306
(213) 882-0422. Custom COM & NAV VHF antennas.

VARIVIGGEN

PHOTO OF STANDARD VARIVIGGEN AND SPECIAL-WING VARIVIGGEN OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take Off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft Stick	49 mph
	Landing	500 ft
Performance with 150-hp. Special Performance Wing	Climb	1000 fpm
	Cruise	158 mph
Specifications Standard VariViggen	Canard Span/Area	8ft/18.3 square ft
	Wing Span/Area	19ft/119 square ft
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications	Wing Span Area	23.7ft/125 square ft

Special Performance Wing Gross Weight 1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh 72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA SAE, AOPA, AND AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43kts) it will still climb 500 fpm roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73 and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips". Gas service and other airport services have been better too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION.
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS.

AIRCRAFT SPRUCE & SPECIALTY CO. 201 W. Truslow Box 424, Fullerton, Ca 92632 (714) 870-7551
VariViggen spruce kit, plywood kit, hardware, all aluminum and fiberglass. Catalog cost $3.

KEN BROCK MFG. 11852 Western Ave., Stanton, Ca 90680. (714) 898-4366.
VariViggen prefabricated components: all machined parts. Catalog costs $2.

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave., Dayton, Ohio 45424. (513) 845-9872
VariViggen plexiglass canopy

BILL CAMPBELL Box 253 Phelan, Ca 92371
VariViggen brackets and fittings.

MONNETT EXPERIMENTAL AIRCRAFT INC., 955 Grace St Elgin, Ill 60120 (312) 741-2223
VariViggen molded fiberglass parts.

GOUGEON BROTHERS, 706 Martin, Bay City, Mi 48707

VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS 4102 Twining, Riverside, Ca 92509
VariViggen welded nose and main landing gear. 1-1/4" sq. steel tube.

JESSE WRIGHT (VariViggen builder) 7221 S. Colorado Ct. Littleton, Co 80122 (303) 771-5140
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8" x 10" glossy photo and current issue of newsletter. Price - $10.00 first class mail, $11.50 Air Mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook i including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price - $6.00 first class mail, $7.50 Air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, and flight reports as possible. Details mandatory, desirable, and optional changes to plans and to owners manual. A newsletter subscription and back issues starting with CP#19 are mandatory for those with VariViggen under construction. Identifies new material sources as they become known. Published quarterly. Price - $4.75 per year first class mail. $6.50 per year air mail overseas. Back issues, $1.00 ea.

VARIVIGGEN PLANS - SECOND EDITION. This is an updated, revised set of very complete drawings and construction manual consisting of a bound 11" x 17" book, containing many photographs, hints and instructions based on actual builders experience over the part several years. It covers the entire airplane, including the engine installation fuel system, and not only covers the original standard wing in both aluminum and foam an fiberglass composite, but it also includes the composite S.P. wing, ailerons, and rudders. The manual identifies sources for all required materials and all available prefabricated parts and components. Price - $165.00 first class mail, $177.00 Airmail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18% - size radio controlled model airplane built and flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment and engine in the .35 to .65 cu inch size. 555-sq wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines) Price - $475 first class mail, $5.50 air mail overseas.

THE CANARD PUSHER No 22 OCT 79

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Back Issues	$1.50

Note! Price increase for the Canard Pusher Newsletter. This is due to the higher costs of the paper, printing and builder support. This is our first increase since CP# 1 in 1974. If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 22. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 22. If you are building a VariEze from the 1st Edition plans you must have newsletter 10 through 22. If you are building a VariEze from the 2nd Edition plans you must have newsletter 16 through 22. A current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 9:00 to 12:00 and 2:00 to 5:00 on Monday through Saturday. If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed your reply. RAF Activity since the July newsletter has included developmental tests on the Long-EZ, flyins to Oshkosh and Columbia and builder/flyer support. The Defiant program is inactive, awaiting financing.

COMPOSITE WORKSHOP - VARIEZE, VARIVIGGEN & QUICKIE A construction - composite seminar will be held at RAF, Building 13, Mojave Airport, Mojave, Ca 93501, on November 24th. 1979. Since construction methods are similar, we are doing this jointly with Quickie Aircraft Inc. There will be flight demonstrations of the Quickie, EZ, Long-EZ, VariViggen and Defiant, between 10am and 11am. Lunch will be arranged from 11 to 12:30 and the workshop will run from 12:30 to 5pm. Builders are encouraged to bring parts, particularly if you have a part that you are unsure of, bring it so that it may be inspected, or used to educate other builders. Mojave Airport is a two hour drive north of Los Angeles on Highway 14: 25 miles on the 355 degrees radial from Palmdale Vortac. Bring folding chairs if you can, wrap up warm, it can be chilly at Mojave in November.

OSHKOSH 1979 - All of us at RAF flew to Oshkosh this year and had an enjoyable trip. We took two new aircraft - Long-EZ and Defiant, also Mike and Sally's VariViggen plus a Grumman Tiger. Due to an "off the cuff" comment to Jack Cox last spring we found ourselves committed to a non-stop Mojave-Oshkosh flight with the Long-EZ - Defiant. We were also scheduled to fly in the opening day airshow, so why not take off from Mojave to do it? After all, there's no arrival traffic at airshow time! So opening day we fueled up the airplanes, put three people plus baggage in the Defiant and took off on our 1780 mile trip. The flight was beautiful - excellent weather and good winds. Because we didn't know how long we would orbit to wait our turn in the airshow the Defiant made a refueling stop at Laramie Wy while the Long-EZ, not wanting to wear the tires unnecessarily, orbited over-head. We arrived at Oshkosh after 9.9 hours flying time (Long-EZ) and found we had to orbit about an hour for our slot in the airshow. Mike Melvill, who flew out two days before, joined us in the orbit and we did our three ship routine before the largest crowds ever at Oshkosh. Average speed for the Defiant/Long-EZ on the trip was 180 mph including the Laramie stop (189 mph stop not included). The Defiant burned 11.2 gal/hour, Long-EZ 5.4 gal/hour. Average tailwind was about 10 knots.

All three of our aircraft flew numerous times during the week in the airshow, fly by pattern and demos. One afternoon EZ pilots literally saturated the fly-by pattern with VariEzes. The Long-EZ flew, after the non-stop from Mojave, two airshows, a demo, a trip to Fond du Lac and a practice LBF lap and still had two hours of Mojave fuel remaining!

It was certainly exciting to see 41 VariEzes at Oshkosh. However, the icing on the cake was when the Grand Champion Custom Built award went to a gorgeous Canadian VariEze built by Norman Ross. See the October 1979 Sport Aviation magazine for an excellent article on Norm's airplane written by Jack Cox. Incidentally Norm also won the Grand Champion prize at the Tullahoma Flyin in Tennessee.

The following are those who attended the 1979 Oshkosh event:

N79RA	Dick Rutan	Ca	(Long-EZ)
N78RA	Burt Rutan	Ca	(Defiant)
N27MS	Mike Melvill	Ca	(VariViggen)
N111EZ	Jeff Rose	Tn	(VariEze)
N76WJ	J & W Melville	Ca	(VariEze)
N66EZ	Bob Voughan	Tn	(VariEze)
N20VE	J.L. Murphy	Fl	(VariEze)
N77LF	L. Foster	Ca	(VariEze)
N240EZ	George Scott	Ga	(VariEze)
N2NP	Nat Puffer	Mn	(VariEze)
N752EZ	Steve Stuff	Wa	(VariEze)
N34EE	Stan Hill	Ca	(VariEze)
N2280K	John Neils	Mt	(VariEze)
GCMEZ	Eric Taada	Canada	(VariEze)
N7EJ	E. Freeman	Co	(VariEze)
N22809	Ray Cullen	Or	(VariEze)
N51WC	M Stockton	Ks	(VariEze)
N37840	Fred Keller	Alaska	(VariEze)
N18VL	V. Larson	Co	(VariEze)

N770DY	D. Yoakam	Fl	(VariEze)
N7WC	W. Curd	Mo	(VariEze)
N91CL	C. Langerud	Tx	(VariEze)
N57EZ	B. McKean	Tx	(VariEze)
N837	B. Duarte	Tx	(VariEze)
N27RG	R. Ganzer	Ca	(VariEze)
N26JW	J. Wright	Mo	(VariEze)
N4ZZ	Ken Swain	Ca	(VariEze)
N90331	Bryan Giesler	Co	(VariEze)
N9113A	W. Brin	Ca	(VariEze)
N79PJ	Phil Supan	Ca	(VariEze)
N301RW	R. Woodall	Ma	(VariEze)
N123EZ	B. Muirhead	Co	(VariEze)
N13CF	C. Cottle	W. Va	(VariEze)
N25TB	Tom Bradford	Ky	(VariEze)
N84ST	Ken Forest	Ca	(VariEze)
GCVEZ	Norm Ross	Canada	(VariEze)
N747TC	Ted Cassity	Mo	(VariEze)
N37S	River Stone	S.C.	(VariEze)
N575JW	* J. Wagner	Mi	(VariEze)
N17DR	* R. Williams	Mo	(VariEze)
N5WZ	* E. Wielan	Mn	(VariEze)
N41GL	G. Laurenzo	R.I.	(VariEze)
N808CM	* Cal Molinea	Mi	(VariEze)
N48EZ	Ray Richards	Oh	(VariEze)

* These pilots did not register at Oshkosh.

LBF RACE 1980 - We are planning a VariEze class within the LBF competition. (see October 1979 Sport Aviation). The VariEze is not designed as a race aircraft and is thus not competitive enough to win the LBF. However, a class for just VariEzes, with its own separate award/prize would be appropriate, competitive and fun. We are suggesting that EZ's enter under the single place rules rather than two-place so they do not exceed gross weight limits. They would thus compete with each other for a prize awarded to the best three category (L, B & F) performance for an EZ. See page 23 December 1978 issue of Sport Aviation for complete race rules.

We are looking forward to a lot of VariEze participation next year so start planning now. The only rules (besides the LBF rules) is that the structural materials and external shape/size of the airplane be per VariEze plans. Clean up items like wheel pants, fairings, etc are legal. Any engine is legal. We are working on a sponsor for the prize money and will report on this in CP 23 or 24. The following is a list of those EZs that have flown since CP #21. If you know of someone who should be on this list, contact us so they are included should an emergency safety advisory be necessary.

Bill English	Houston	Tx
Terry Brokaw	3 Rivers	Mi
David Morgan	Middletown	Oh
Lee Roan	Temple City	Ca
Stan Hill	Santa Barbara	Ca

J. Chestnut	London	Ky
H. Steinhoff	Goleta	Ca
R. Johnston	Tracy	Ca
Bill Stamm	Bellview	Wa
Bob Woodall	Adelphi	Md
G. Bowman	Tok	Alaska
John Collan	Louisville	Ky
Elsworth Hamel	Waynesburg	Pa
Ted Martin	Rosewell	N.M
Bruce Evans	San Deigo	Ca
Don Neary	New Fairfield	Cn
Cliff Winter	Huntsville	Al
Jim Trombino	Waukegan	Il
Jim Langley	Leavenworth	Ks
Roger Klemm	Champaign	Il
Joe Lawyer	Mesa	Az
Jeff Danes		Australia
Greg Coln	N. Ridgeville	Oh
M Perry	Brookshire	Tx
K. Jeffers	Less Summit	Me
J. Steichen	Downers Grove	Il
F. Fergus	La Mirada	Ca
D. Freeman		England
E. Pruett,	Tracy	Ca
T. Gehres	Orlando	Fl
Dave Wenen	Littleton	Co
Edra Parker	Buena Park	Ca
D. Martin	Fresno	Ca
Ray Eby	Wilkesboroug	NC

VARIEZE HOSPITALITY CLUB FLYIN - A total of 18 Airplanes flew into Columbia, Ca over two day period, 20 & 21 of October. Unfortunately it rained Saturday, but was perfect all day Sunday. The EZ from the farthest south was from Chino, unfortunately none of the guys from San Diego made it, due to bad weather. In fact, if weather had not been a problem, there was a potential of around 30 VariEzes flying in. The Defiant, VariViggen and Long-EZ flew in from Mojave. Don Shupe made up a few awards, Ed Hamlin - for Best builder support. Les Faus - for giving the most back-seat check-out rides and most hours (100 and 475 hr. t.t.). Bruce & Bonnie Tifft - for Super Flyin coordinators. Dick Rutan - for a "Reluctant" Aerobatic Instructor. Everyone had a great time and all were in favor of doing it again soon. Probably January or February, time and place, not decided.

VARIEZE FLYIN, GAINSVILLE, GA - The "Real" George Scott of Cumming, Ga, organized a flyin over the weekend of 20th & 21st October and had six VariEzes fly in. Three wards were given, Bob Woodall - the Longest distance award. Robert Vaugn - The best overall and the best interior. Jeff Rose - the spot landing contest.

VARIEZE OPERATOR EXPERIENCE - We received many favorable comments about this section of Newsletter 21, so we will plan to make it a regular column. Bruce and Bonnie Tifft - "Here's a fun trip for a Eze owner. You leave on Friday - spend Friday night and half Saturday at the Hollister Flyin with eleven other Ezes. Then we left with three other Ezes (Hamlins, Shupes and Les Faus) and flew to Auburn for lunch. We spent the night at the Hamlins. Late Sunday afternoon we flew over to

Mendocino but found it was fogged in - so we proceeded to Napa for a late lunch (San Francisco area).

Early Monday morning, the Shupes left for Los Angeles and we proceeded north on our way to Paco, Washington. Flying over country like Mt. Shasta and Crater Lake was certainly a thrilling experience. We spent the week with relatives in Pasco - giving rides to the nephews and to a very nice hangar owner who gave us a corner of his hangar for the week - you know how we can squeeze in. We participated in the Blue Skies fly-in the following week-end and did a few fly-bys for the spectators. The Shupes and Hamlins stopped for Saturday evening and then were off Sunday on their way to a Canadian vacation. Sunday morning we headed for Mariposa and then on home Monday.

The trip put 18 hours plus on our Eze which is the longest single trip we have had in our airplane and loved every minute. Perfect weather and perfect Eze performance made for a fun and inexpensive trip. We have total of 131 hours on the Eze now and are looking forward to many more enjoyable excursions".

The "Real" George Scott - "Interesting problem flying a VariEze cross country - I was east bound level at 5500 ft. Another aircraft appears to the right also east bound at the same flight level on a path that will cross slightly behind us. He thinks we are going backwards and since the aircraft to the right has the right of way he turns to the right to pass behind us! I'd sure like to hear his version of what he thought he saw and the evasive maneuver that followed!"

Larry and Janet Lombard - "just a short note in appreciation for the follow-up on the fuel contam. problem. Fortunately, our EZ shows a clean bill of health. We flew the trek to Alaska via Alcan and had a wonderful vacation. We stayed with Tom Kuffels, Fred Kellers and fished a lot. Those folks up there are Great people. We flew the 2600 plus mile trip (one way) on about $100 fuel and averaged 155.8 mph. Our longest leg was 770 miles at 4.45 hour and (with one hour reserve) Janet didn't show too many signs of fatigue. We were a tad over gross though - - - about 1130 for take off, really makes that C-85 grunt. We had many requests for buzz jobs by Canadian towers . . . . and they wanted it in tight over the ramp, not out over the runway. . . . very curious people about the EZ. Thanks again."

Dick Woods/Bobbi Cohen - "EAA Chapter 62 held their annual flyin at Hollister, Ca on July 13 1979. Each gal was asked to bring a cake for the dessert part of the Saturday night banquet. We've got so many VariEze's under construction in the chapter that Bobbi decided to contribute one of her own - an edible variety. The folks in charge of the dinner decided it looked too good to cut, so they planned to award it to the Grand Champion of the show - Larry Lombard's beautiful VariEze! Rather fitting, don't you think. (And we all did get to eat the cake finally on Sunday at a cook-out at Reid-Hillview airport). Here's a photo of the vanilla "VariEze". (pg 11)

Otto Schimmel - "Enclosed are pictures of first flight which Dick Rutan flew in June 1979 at Mojave, Ca. N9036G, VariEze was built by George Gilmer, age 73 years young. Three years total time at Santa Paula airport, Ca. Total cost was about $3600. George made almost every part. Wing fittings, wheel and brake system, throttle quadrant etc.

He advises all builders, if Burt gives a measurement or method there is a reason. He believes that in all his years the VariEze and plans are the best there is. George started flying in 1929. But had one big thrill when Mike gave him a ride in his VariViggen".

Wilma Melville - possibly the only woman VariEze pilot, Wilma Dasche-Melville, has completed her 100th hour in the airplane which she and her husband John built over a period of 1 1/2 years. A P.E. teacher from the Torrance, Ca school district, she included the EAA Oshkosh fly-in in her schedule. Note: John built the EZ with Wilma's help, but he is not a pilot and is thus confined to the back seat!

Helma Hamel - "last May, after I heard my husband Ellsworth groan over the changes in the last newsletter I made up the enclosed "poem". I wanted to send it to you, but Ells thought it was too corny. Well, I just mailed to you the announcement of Ell's first flight in VariEze N235EH and I decided to mail the "poem" too. You still might get a smile out of all that corn. It was a tremendously scary and exhilarating moment, when Ells started climbing. There is nothing in my life that can compare to the shudder and thrill I felt, not even the birth of our first child.
First the announcement -

She Flies.

1976
Summer: A dream, a wish, and a gigantic set of "How-to" plans.
Autumn: We take lessons, place our order with the stork and ready the nest.

1977
Winter and Spring: Ouch! What labor pains! It takes 6 months for the whole egg to arrive
Summer and Autumn: We are hatching. Every spare minute we are hatching.

1978
Winter: We have to keep the egg warm through the harsh Pa. winter, so we build an incubator.
Spring: Still hatching.
Summer: There she is: a complete bird, ugly, green and blotchy, but her wings are in the right place.
Autumn: We care for and feed an insatiable bird. She sure can swallow the dough.

1979
Winter: Her nervous system is maturing, her reflexes look good.
Spring: The great metamorphosis: The blotchy green fledgling changes to coal black, then to shining white. But Dr. Rutan orders corrective surgery for her and all of her species.
Summer: She is whole again, and she has a voice after some hiccoughs and sputtering she purrs.

AUGUST 13 She is flexing her wings, she is airborne.
IT'S A BIRD! IT'S A PLANE! IT'S VARIEZE N253EH!

Now the Poem -

St. Peter's Lament

St. Peter shook his haloed head and scratched his grizzled beards
I don't know what to make of this; it's positively weird.

Each ninety days a monstrous moan floats upward to the skies,
A sound so woebegone and sad, the angels wipe their eyes.

It starts to build around L. A., and by the second day,
It echoes and reverberates across the U. S. A.

I strain to glean from all this din just one revealing word,
But what the voices clamor for seems freakish and absurd.

They wailed of "worm gears", shrieked of "cuffs" until I plugged my ears.
They howled for "rod ends" and such stuff, and now it's "landing gears."

I hear some fellow is to blame, some airborne desert chief,
A real designing so-and-so, who thrives on all this grief.

He tinkers, toys and tabulates and smells of gasoline.
He rules a back room printing press, an instant-gloom machine.

He mails a little quarterly, the source of all distress
From desert hide-out to the world, it's called THE DOOMSDAY PRESS.

And every man who reads his news will instantly be changed.
Some grow morose, some snarl and snort, some end up quite deranged.

Some yells "The ripper strikes again!" Some throw epoxy fits.
Some sobs "By Jove it's VariHard." Some drown their grief in Schlitz.

I yearn to zap that scoundrel now. I'm certain of applause.
But strange enough some heavenly host have rallied to his cause.

The Life Extension Service claims, because this fellow cared
A dozen men, who had been marked for reaping, have been spared.

The cherubs plead the poignant fact, that he's an ace, he flies.
Can I think ill of any man who reaches for the skies?

They've seen his wings; they call him kin; that sways me, I admit,
For flyers are a noble breed, a joy, and full of grit.

Is he a rogue or lily white? I only wish I knew.
I hear he's looking for new fields and brand new things to do.

He says - this caper leaves me stunned, his brashness I deplore -
He just designed a better wing for my own angel corps.

LONG-EZ N79RA UPDATE - Today the Long-EZ has 102.4 hours, a new set of wings with different winglets, and longer ailerons. The standard VariEze wings did not work well and were abandoned after Oshkosh. We burned the midnight oil and designed and built a new rear wing system. The 23-degree L.E. sweep, Eppler airfoil, and wing attachments are similar to the Defiant. Improved foam core jigging and glass lay up methods were developed. The 42% increase in wing area was made with very little weight increase. The wing spar and center section spar overlap and are connected with three bolts in shear that allow an EZ wing incidence change with shim washers. We are very satisfied so far with the performance. We have excellent stall characteristics with a wide departure margin. We don't anticipate ever needing wing cuffs. The aircraft is very stable at full aft cg. This cg limit is reached with a Lycoming 0-235 with starter, alternator and fuel pumps and a 125 lb pilot - no ballast. The approach and landing speeds are 5-6 knots lower than a VariEze. Deck angle is low enough that the over-the-nose-visibility is excellent at touch down with full aft stick! Useful load is increased over a VariEze, resulting in a single-place range of 1400 miles and two-place range of 800 miles. However, we're still not finished. At the new lower takeoff and landing speeds the rhino rudder effectiveness is inadequate which may force us to revert to the conventional winglet-mounted rudders (I see some of you smiling). We are so encouraged with the new wings and overall flying qualities that we have applied to attempt a world class-closed course distance record this fall. Please understand the LONG-EZ is not finished - its still in flight test and more things could change. But we are very close to a design freeze. Complete details on the Long-EZ and plans will be in CP 23. Please wait further questions till then - we need to get the work done!

TECHNICAL CORNER - We will plan to make the Technical Corner a regular feature of the Newsletter. VariEze materials tested to support Space Shuttle - NASA's Dryden Test Center recently flew an F-15 fighter with a wing addition constructed of three pound urethane foam skinned with four plies BID/Epoxy. These wing additions were subsequently covered with space shuttle tiles, to test their ability to withstand loads expected during reentry. The bare BID/foam additions were flown to 1.5 times the max expected dynamic pressure of the shuttle - 1100 lb per square foot, at 1.4 mach, 660 mph indicated speed. This is a dynamic pressure of nine times that of a VariEze at red-line speed!

The equivalent flat-plate drag area of an entire VariEze is less than 1.5 square feet, or roughly speaking, an EZ has the same drag as a square flat board 14 inches on a side. With this small amount of total drag, adding drag-producing additions will have a large effect on the aircraft's performance. For example, a cross-over exhaust system will slow the cruise speed by 10-15 mph, due to the drag produced by the blunt bumps required on the cowling. This increment has been verified by everyone who has made this exhaust change. The bumps also cause turbulence that increases prop noise.

Moisture change - moisture on a wing from rain will effect its lift. This effect is small on a conventional aircraft, ie, the Grumman Tiger descends 500 fpm if untrimmed entering a rain shower, but is easily trimmed out. A Canard aircraft generally has a much larger trim change in rain because its high lifting wings are located far apart. We do

not fully understand the reasons for this, but the following characteristics exist for most VariEzes: if a trimmed

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EZ enters light moisture or light rain it will climb, requiring about 1/2 lb to 1 lb push to maintain level flight. In heavy rain, most EZs trim nose down, requiring a mild aft stick pressure to fly level. The trim change varies with speed, being barely perceptible at 70 knots and higher as speed is increased. One EZ flyer reported a heavy aft force required (15 to 20 lb) when making a 150-knot (172 mph) descent through a heavy rainshower.

We often hear the following comment from EZ pilots who have just flown their airplanes, "my speed is low, I set the power for 2650 rpm (75% power) and only get 166 mph true". You are not at 75% power, just because you have set the rpm for that power on the Cessnas you are used to flying. Remember, the EZ has very wide speed range for a fixed-pitch prop. To get adequate take off performance, the EZ has to turn high rpm at 75% cruise. Refer to the following chart for a clean 0-200 EZ with Ted's prop and wheel pants. At 8000 ft and 2650 rpm you are generating only 49% power (a good economy cruise). To get 75% pwr at 8000 ft you have to use full throttle and turn 2990 rpm at a TAS of 193 mph. We generally do not cruise at 75% - we prefer 60% or less to conserve fuel and reduce the noise level. 60% gives a TAS of 178 mph and fuel flow of only about five gal/hour at peak EGT. Static rpm - if you have a static rpm of less than 2450, with the 0-200 or 0-235 engine, you will have poor takeoff performance, due either to too much prop or a sick engine. Be sure your tach is calibrated. The hand held Heath kit thumb tach works well. Can even be used in flight, just point it back from inside the cockpit **GRAPH OMITTED**

FLYING HINTS - Check your aileron hinges for wear (particularly the inboard hinges) and lubricate with a dry graphite lube. Some builders have reported wear that stopped when lubricated.

Clarence Langerud reports solving his engine cooling problem. He added a 5" long 2" wide strip of .032 alum to the front baffle and bent a 1/2" radius on the center and aft baffles (see dwg) **SKETCH OMITTED**

For those who fly in rain and have had prop tip damage, Bruce Tifft of B & T Props has developed a wood prop with a hard rubber or urethane leading edge, that has proved impervious to damage at full throttle in very heavy rain. Note that B & T Props address was printed incorrectly in CP #21 and should be - B & T Props 8746 Ventura Ave., Ventura, Ca 93001 (805) 649-2721

George Scott suggests a neat way to improve your proficiency before flying your VariEze. George used a Cessna 172, sat in the right seat, reclined the seat to stimulate the seating position of the EZ, then go out and practice some high speed taxi, runway flights and landings. Do take a safety pilot with you in the left seat!

FLIGHT SAFETY BULLETIN - A VariEze experienced a forced landing due to engine failure caused by collapse of the induction hose. The owner had

not safetied the wire and cord as per the instructions and drawing (Sect II A page 14 - 1st Edition, Section IIA page 17 2nd Edition, Section IIC page 13). If these are not safetied the cord can unwind, allowing the wire to twist and lie flat. Inspect your induction hoses. If they are not safetied, ground your aircraft until corrected. This bulletin was included in our fuel compatibility questionnaire.

Flight Research Inc, reports a service failure of the strut support tab of their VariEze R/H muffler. Their recommendations:
1. Inspect attachment tab regularly
2. If tab has failed, weld on larger and heavier gauge tab prior to next flight.
3. If no certified welder is available, send R.H. exhaust unit to Flight Research Inc., for free repair.

BUILDER HINTS - Engine baffling - Lyc 0-235. When you cut your baffle material out according to Section IIC errors exist leaving the aluminum pieces short in some areas. Leave the Baffles about 1" too large, then trim to fit cowl. Leave 1/2" gap between the edge of the aluminum baffle and the cowling on trim before installing the rubber.

John Harris recommends a large farrier's horse shoe hoof rasp for shaping foam, roughing glass etc. We have found an excellent substitute for sand paper in the form of a Disston Abrader (course #401C) available at most hardware stores. Aircraft Spruce is now stocking the 401C. It is a long-life abrasive tool that's excellent for shaping curved fiberglass edges.

We recently tried a new product that is a big time saver. It is an acceptable substitute for dry micro in the finishing process. Stitts micro-putty (MP 1100) available from: Aircraft Spruce and Wicks. This is a polyester - based material similar to Bondo, but 1/3 the weight, cures in a few minutes and works and sands similar to dry micro. Caution: do not use on blue foam.

Steve Briggs found an excellent method of setting wing incidence. While wings are still in the jig, on the table (both root and tip water lines level) bondo a Stanley line Leveller (available at most hardware stores @ approx. $1.60 each) to the outboard edge and parallel to the buttline of your WA-1-1 wing fitting. Check that the root and tip water lines are level and that the Stanley is level before removing wing from jig. Use this level later to adjust wing to center spar (replaces the bondoed board, from CP #12 page 8).

A finger tip saver when finishing featherfill through final color coat, use a sponge with sanding material bonded to it, sold at hardware stores as Quicksand/Auto Wetdry, Medium/course.

Nat Puffer sends this idea to check your epoxy balance for accuracy. Simply put 20 nails in the hardener cup and 100 nails in the resin cup, or for the new Safe-T-Poxy system, 43 nails and 100 nails. Nat says it works great.

For those of you having difficulty drilling the 8 holes in each wing fitting, F.J. Wells recommends a Stanley drill Guide #04-413 glued to the WA 1 fitting with beads of hot melt glue. Produces excellent, perpendicular holes. Jake Bach reports that he modified his Michael's

Engineering ratio pump per CP 21 and got 39-100 instead of the desired 43-100. He then switched the pivot from the left to right (hardener piston greatest distance from pivot) and that put him right on the money. We don't know why his pump is different than ours, but we caution you to be sure to check your ratio if you modify your pump - pump into two cups and check on a balance scale.

Don Yoakam reports that if you update from old to new style Rosehan brakes, be aware that toe-in may change. The backing plates are rough castings and may not attach in the same position.

Sam Cochran made a carb heat valve using two Campbell soup cans covered with two plies of B.I.D. His has over 100 hours with no wear or defects.

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Solution to "back off" of roll trim servo. Some EZ flyers have experienced their roll trim tab being forced toward neutral due to airloads in flight at high speed. Garth Shearing, Canada, a VariEze builder has pointed out that the servo cannot be backed up if it is shorted across the motor terminals. Yes, I didn't believe it either, but it's true - try it! The following circuit can be used, which requires two DPST switches - one for left trim, one for right. This wiring will provide a short for the motor at idle, locking it in position and provides protection from both switches being operated at the same time. **SKETCH OMITTED**

The fuel tank vent can be covered in a steep climb and result in some venting of fuel. To avoid this (new construction only) position the vent tube 15" forward of its position shown. Enter the tank at the plans-position then route the tube forward - this avoids conflict with canopy latches.

GOOD NEWS

Many of the VariEze operators have experienced inaccuracies in the designated engine instruments particularly the Tach. Because of this, on the recommendation of Jim Proctor of Shady Cove, Oregon, we installed a completely different line of instrumentation in the Long-EZ. This new instrumentation has performed very satisfactorily. We feel these are superior to what have been recommended before. Example- this new Tach runs independently of the magneto switch, using a very small sender that screws right on to the engine tach drive. This small sender will run two tachs. We were impressed with its accuracy and reliability. Our calibration of all these gages proved them to be accurate. (However, any instrument should be calibrated prior to use). The Vendors are on line and this new instrumentation is being stocked by Aircraft Spruce and Wicks Aircraft Supply. Specific gages should be ordered as follows:

GAGE	PART #
Carr Electronic Tachometer	206
Carr Electronic Tachometer Sender (includes adapter kit)	207
Oil Temp. 120 - 300 degrees F	VDO 310-014
Oil Temp Sender	VDO 323-057

Oil Temp Wiring Kit	VDO 240-023
Cyl Head Temp 100-600 degrees F	VDO 310-909
Cyl Head Temp sender	VDO 323-701
Cyl Head Temp wiring kit	VDO 240-701
Volt Meter 8-16 volts	VDO 332-044
Volt Meter wiring kit	VDO 240-024
Engine Hour Meter	VDO 331-011
Engine Hour Meter wiring kit	VDO 240-024
12V Chronograph (clock)	VDO 370-022
Oil Pressure 0-150 psi **	VDO 350-044
Oil Pressure sender	VDO 360-004
Oil Pressure wiring kit	VDO 240-023

** This gage can be wired to include a low pressure warning light. We have this in Long-EZ.

SAFE-T-POXY - We have been using Safe-T-Poxy extensively here at RAF over the past 6 months. The new Long-EZ wings use Safe-T-Poxy. During this period the temp's were warm 80 degrees - 100 degrees, and the epoxy worked beautifully. However, lately with temps dropping down into 60 to 70 degrees the Safe-T-Poxy wets slowly. This can be solved by placing a light bulb under the ratio pump to get the temp of both the resin and hardener up around 80 to 90 degrees.

When mixing micro balloons with Safe-T-Poxy, only 3M B23, 500 (available from Wicks and Aircraft Spruce) glass balloons should be used. If you use Quarts Q-cell balloons, due to alkaline, the cure will be delayed, depending on temp as much as two or three days. Although it does ultimately cure, and is structurally ok, this much delay, particularly in finishing is not acceptable.

Safe-T-Poxy is now available from both Wicks and Aircraft Spruce, and is excellent in all respects. All physical properties are equal to or exceed those of RAEF and S. Safe-T-Poxy particularly excels in fuel compatibility and low moisture absorption. We continue to receive reports that Safe-T-Poxy has definitely solved the health problems of many people that are allergic to normal epoxies.

ROTORWAY RW-100 UPDATE - Our latest information is that the prototype engine has been taken out of the VariEze and an aggressive test cell development run is underway. We are encouraged to hear that their advertising blitz has been put on the back shelf and the major effort is now on engineering development. We are also gratified to hear that the cam/valve overlap has been changed to allow hand propping. Without starter and ring gear the weight may be within VariEze limits. We are encouraged that the development is continuing and the performance and reliability will be determined. A new 100 hp aircraft engine is certainly needed. We wish B.J. Shramm all the success in his effort. We will continue to monitor this program and will test an engine when appropriate.

HIGH COST OF ENGINES - We have been hearing a lot of complaining about the high cost of engines. True, a new engines' cost is approaching ridiculous. But, if you can find a partially run out engine it can be more of a bargain. The Long-EZ has a Lycoming 0-235 that had 1400 hours and it cost us $1500. It was installed without modification or repair. The Lycoming has a 2000 hour TBO so we can expect 600 hours

flying on this engine (3-4 years). When it is "run-out" - 2000 hours in 1982 it will still be worth what it cost us. Thus, its truly a low operating cost engine (zero $)! This newsletter lists a 400 hour C90 at $2800. If you run it out (1200 hour left) then sell it for $1500 you have spent $1.08 per hour for engine. If you buy a new or newly over-hauled engine at the high going cost, and sell it for run out cost, you will spend $2 to $3 per engine hour. Remember the majority of you will take years to put a few hundred hours on an engine. So, consider a 1/2 or 3/4 run out - its still a bargain. Run an add in Trade-a-plane (Crossville, Tn 38555), it works!

HOMEBUILT PROPELLER - We have just reviewed the plans for a home built VariEze propeller by Larry Weishaar and have tested a homebuilt prop built from his plans. The plans are a true manufacturing manual, very detailed. The 32 page photo-illustrated document contains a full size drawing and station templates and a considerable amount of technical information from cutting down the tree to the finished balancing. With these plans I believe anyone could build an excellent prop. But what about performance? We have in the past used Teds 56 x 76 prop as the standard because it gave about the best performance of any we have tested. Again we were impressed for we found Larry's prop to be every bit as good as Ted's and possibly a slight bit better in cruise. The sample prop was quiet and smooth and seemed to scavenge the engine cooling air better, as the climb CHTs were down 20 - 30 degrees F. We are happy to give Larry our wholehearted endorsement and congratulations for an outstanding set of plans. A real bargain at $17.50, they may be purchased from:

Larry Weishaar,
1924 No 6th Street,
Springfield, Ill 62702
(217) 544-6086

DISTRIBUTOR REPORT

Aircraft Spruce and Wicks.
Both report VariEze kit and materials are all in stock. Partial or complete kit orders are being processed within a few days. Customers can pick up a complete kit with a one week notice. Both distributors currently stock RAEF, RAES and SAFE-T-EPOXY.

Ken Brock Manufacturing.
Ken has been doing an excellent job in stocking adequate quantities of the EZ components allowing prompt delivery. Ken now has a good stock of EZ prop extensions, axles, wing fittings, welded parts, crank nose gear assemblies, spinners, etc. Ken's spinner is a completed item, not a kit. It requires only the prop cut outs to install.

The Airplane Factory.
EZ canopies and Viggen canopies are in stock and being shipped promptly. TAF offers a 1/2-price replacement should you break your canopy for any reason in the first three years.

Fiberglass Parts.

The vendor for the VariEze fiberglass parts notified us last July that he was modifying his business operation and would discontinue manufacturing the nose and main gear parts, but would supply them until we could locate another source. At that time we decided that, since tooling for the main gear was wearing out, we would not arrange for the new manufacturer to produce this same item. Instead, we are developing a new gear, which is 40% stronger and made with an improved process. This gear is designed specifically for the Long-EZ, which has a gross weight 24% heavier than a VariEze. We plan to have only this new gear produced by the new vendor, and use it on both the EZ and Long-EZ. It is three to four lb heavier than an EZ gear. We have also developed an improved main gear attachment design which is now being tested on the Long-EZ. Once the tests are done and the new gear is in production we will make the gear (and gear attach design) standard for both the Long-EZ and new-construction VariEze.

Last month the fiberglass vendor informed us he would no longer produce any of the VariEze parts, after clearing his present backlog. We are busy setting up the details for a new vendor to produce the cowlings, nose gear cover, and nose wheel box. Unfortunately, due to time delays in transfer of our tooling (the old vendor needs to finish his backlog), there will be delays in the availability of these parts. We are taking this opportunity to address some improvements in cowling shape to reduce aerodynamic drag and improve cooling. We should have complete details on the new parts in CP #23. Availability of all the new fiberglass parts is expected by mid December. Contact us after that date if you are needing parts before CP #23. We regret that this condition will result in delays for some of you. However, once these parts are in production they should be off-the-shelf, a considerable improvement over past availability.

In setting up the production and distribution of fiberglass parts with the new vendors, we want to be sure to have an arrangement that provides good service to VariEze customers. We would appreciate hearing feedback from those who have dealt with the old vendor so we can assess if any improvements are needed in the areas of pricing, availability, customer service, etc. Please let us hear from you.

FOR SALE Because of an engine change, I have an unused Cassidy prop 58" x 67" suitable for a Lyc. 0-235 with an SAE #1 flange 4 3/8" bolt circle diameter.
Dewey Straley,
488 Fairfield Ave.,
Gretna, La 70053

Lyc. 0-235 for sale.
W.E. Clark,
116 West University Pkwy
Balto, Md 21210
(301) 889-5092

Lyc. 0-235-CI for sale $2200
Al Kramer,
Sal Val Aviation
Van Nuys Airport,
Van Nuys, Ca.

Dan Lee has found some small (1.15" dia) volt meters and ammeters, to check solar panel charging.
100 c Volt meter 0-15 DCV - approx $30
100 c ammeter 0-500 DC MA - approx $26.50
Available from - International Instruments
88 Marsh Hill Road,
Orange, Cn 06477
(203) 795-4711

Lyc. 0-235-L2C complete with mags, carb, starter and alternator and fuel pump. 460 hrs. T.T. since new. Crankshaft flange bent .008" - $2900
Bill Aronson - (805) 256-2200

David Turansky, - - - - - - David has an excellent C.P.
433 Herkimer Street, index, CP 10 to CP
Buffalo, N.Y. 14213 21 for $3.00

Continental C-90-16L 400 hr since new, $2800
Dick Rutan at RAF (805) 824-2645

Both Wicks and Aircraft Spruce are now stocking two excellent canopy seals. One, K-Strip is shaped **SKETCH OMITTED** (Wick's Part # 44-57240) works great, and the other, P strip shaped **SKETCH OMITTED** also works very well. These are sold by the foot and although they have an adhesive backing, you may need to supplement this with RTV or silicone.

Posters. RAF has a beautiful poster of our three ship formation - Defiant, VariEze and VariViggen (see back cover of this new newsletter). This photo was shot by Budd Davisson. The poster is color, 18" x 23" and quality suitable for framing. They are available for $2.75 each or two for $5 at RAF. Add $1 if ordering by mail to cover mailing tube and 1st class postage. Specify plain or autographed.

Defiant Film. Ferde Grofe's Defiant film has received some excellent reviews. General Aviation News - "Defiant is one of those rare short documentary films which left us wanting more" - - "delightful film experience". If interested in purchase or rental send SASE to A.V. Library, 18139 Coastline Dr, Malibu, Ca 90265

Survival Kit
Ray and Nova Cullen (see CP 21 Page 2) 1116 6th Street, Tillamook, Or 97141, have developed an excellent accessory for the VariEze. It is a custom light weight survival kit designed to double as an additional thigh support for the rear seat. These are well done and we plan to install one in our airplanes. Contact them for price and availability.

VARIEZE LOSS-OF-CONTROL
We have just completed another series of flight tests on N4EZ to test its departure (loss-of-control) resistance. What prompted this is reports from two VariEze pilots in Texas that they experienced a

partial or full snap roll at about 80 knots. These occurred below pattern altitude and fortunately the pilots managed to recover in time to avoid an accident. The maneuver was described as follows: Full aileron and partial rudder steady sideslip, then full rudder was applied which caused the airplane to yaw excessively and abruptly roll, experiencing negative g. Recovery with neutral control was prompt, but several hundred feet of altitude was lost.

The most surprising thing about these incidents to us was that control was lost at such a high speed - 30 knots above stall. Reinspection of our stall/spin test data and the NASA tests indicated no susceptibility to departure. We then initiated a new test program to investigate this. Dick performed full rudder sideslip with N4EZ at all speeds and experienced no departures. Concentrating on the 80-knot speed range he then aggravated the yaw with abrupt rudder inputs while in a rolled attitude. On one of these he experienced a departure - a roll off in the direction of the slip. He then tried to repeat the maneuver and could not get a departure in over 20 attempts. We then adjusted the aileron and rudder rigging, moved the cg aft, and repeated the tests. Dick found that by learning a specific technique he could cause a departure nearly every time, if speed were above 75 knots and an excessive sideslip angle were generated. The departure generally consisted of an uncontrolled roll away from the rudder input direction. Recovery with neutral controls was prompt. However, on several of the maneuvers the yaw angle was extreme at departure causing a massive stall of the winglets and blanking of the upstream wing. The airplane then yawed past 45 degrees, abruptly rolled, and entered a 1 to 2 turn inverted incipient spin. The airplane always promptly recovered with neutral controls. If aileron or rudder were applied for recovery it could cause a further "snap" departure and delay recovery. Altitude loss on the worst of these maneuvers was as much as 1500 ft.

Why did we not find this departure when we did the original tests and the tests with cuffs in 1978 (CP #19)? The most probable reason is that most of those test were done at high angle of attack (full aft stick) which was thought to be the worst case. However, we have found that at lower angle-of-attack ie, 80 knots, the rudders can generate more sideslip than at high angle-of-attack, and thus can be powerful enough to stall the winglets in an accelerated yaw maneuver. We were then faced with a decision on what to do: (1) caution pilots that the airplane can be departed when using excessive yaw inputs or (2) fix the airplane to improve its departure resistance. Since we feel strongly that good departure resistance is an important asset and design goal for the VariEze, we set out to attack # (2).

We have always known that the EZ has more rudder power than needed for normal maneuvers - a full aileron steady sideslip at low speeds requires only 60% of the available rudder to hold heading. The available travel is 3 1/2 inches, measured at the top of the rudders trailing edge. We then limited the rudders travel on N4EZ in various increments, 3", 2.6", 2.3" and 1.8". At each increment we flew tests to determine departure susceptibility and the necessary rudder authority for crosswind landings.

As expected, the departure susceptibility reduced as rudder travel was limited. After extensive testing and evaluation by three pilots we have N4EZ's rudder now rigged for a two-inch full travel. With this

rigging, the following characteristics exist: crosswind landings up to a component of 24 knots are possible without tire scrub. The aircraft is not susceptible to departure during any normal maneuver. Thus, we are now recommending a mandatory rigging change to limit the rudders to two-inches of travel.

It must be noted that this may not guarantee total departure resistance. This may vary from one airplane to another, due to expected tolerances in things like winglet leading edge finish and shape, fuselage shape etc. Also, even at 1.8 inch rudder travel, Dick was able to induce a departure by learning an unusual and aggressive combination of control inputs: full left aileron, full left rudder at 30 degrees bank, then at 100 degrees bank abrupt full right rudder. When this was done a departure was possible (not probable) even though the rudder was limited to 1.8 inches.

The important thing to note is that, even though this design is not as susceptible to loss-of-control as a conventional aircraft it should not result in over-confidence on the part of the operator. Assume your aircraft is susceptible to departure until proven resistant during your stall tests with lots of altitude and a parachute. Refer to the plans-changes section of this newsletter for a caution note to be added to your owners manual and for instructions on rigging rudders to two inches.

FUEL/FIBERGLASS COMPATIBILITY - This year at Oshkosh, Nat Puffer had a partial power loss on take off and safely aborted. The cause was found to be a large amount of orange gummy residue in the carburetor. Our concern was that there might be fuel/epoxy incompatibility, possibly due to the high-aeromatic automotive fuel he was using. In August we prepared and sent to all known VariEze flyers a detailed inspection procedure and survey questionnaire, to determine any trends. Applied Plastics (APCO) also conducted an aggressive accelerated aging evaluation to determine if the aromatics used in high octane low lead fuel will deteriorate the epoxy. Results: APCO, RAES & RAEF showed a very slight amount of material extracted from the epoxy but well within acceptable limits. Under normal conditions such as the way VariEzes are used it would take years of exposure to extract even a trace. The new Safe-T-Poxy even under rigorous test conditions was essentially unaffected. Jim Tome ran some tests at a major midwest lab found that the aeromatics in automotive and some aviation fuel 100LL will craze and leach out the hardener in a hardner-rich Lambert lay up and this is probably what happened to Nat. Jim also found that the fuel additive "canned heat" and MEK can dissolve the new Safe-T-Poxy. The problems are with the aeromatics the oil companies are using more and more of. This is explained more in our fuel compatibility AD letter.

Out of the 64 returned survey questionnaires, 52 had no problem at all, 10 reported a trace of gummy substance on the float/mixture needle valve. Several mentioned this could cause the valve to stick, this is becoming a common problem with many other aluminum-tank airplanes using 100LL. One reported a gummy substance in the bowl like Nats. We will be analyzing this sample. Our conclusion is that the RAEFs and the Safe-T-Poxy when properly mixed should not deteriorate when exposed to aviation fuel. However, as a precaution we are recommending routine carb bowl inspection. If you are a VariEze flyer and did not receive our survey on the fuel contamination inspection/questionnaire, then we

don't know you are flying. Write to us giving your N number, name, address, and date of first flight. We will send you the survey and add you to a confidential list. This list will be used only to mail you any urgent flight safety information.

VARIEZE PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe. It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft Do not fly until the change is been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety
OBS	Obsoleted by a later change.
MEO	Minor error or omission

MEO	Sect I Page 11-4	AN 960-4 should be AN 960-416 (2 places)
MEO	Sect I Page 17-11	2" thick top foam piece 12.5" should be 15"
MEO	Sect III Page 2	#12 wire can be #18
MEO	CP #20 Page 5	65 lb fuselage weight should be 72 lb.
DES	Sect II Page 21-4	Route vent lines 15" forward within tank
MAN-GRD	Sect I Page 19-12 Sect IV Page 28	Rudder travel - Mandatory change before next flight. Reduce rudder travel from 3.5" to 2.0". This can be done by cutting the cable and

inserting both ends into a nicopress sleeve to shorten the length. Make fine adjustment with the fitting on the top of the master cylinder. The rigging check takes two people- one in the the cockpit pushing full rudder pedal deflection and one measuring at the top of the rudder while applying a mild aft airload (about 3-5 pounds) on the rudder trailing edge.

MAN-GRD Sect IV Page 30 — Under power plant add "inspect induction hoses for correct safety of wire and cord". Perform this inspection before next flight.

MAN-GRD - Sect IV Page 37.

Correct the CP 21 addition to read "before first flight clean and flush all screens, both carb and gascolator. Remove and clean out carb finger strainer and carb float bowl. Check for a gummy substance on the needle valve. Repeat this inspection each 25 hours for the first 100 hr and 50 hrs there after".

MAN-GRD Sect IV page 19 — Add the following paragraph "CAUTION - Avoid aggravated full-rudder, cross control sideslips at low altitude. The VariEze is departure-free at full-aft-stick stall speed. However, at higher speeds the rudders become more effective and a enough sideslip angle can be generated to stall a winglet. If winglet stall occurs at the same time a roll rate is being generated in the opposite direction eg, full right rudder and full left aileron, the aircraft can depart controlled flight. Departure is evident by an uncontrolled yaw and roll. Recovery is normally prompt when controls are neutralized, however if yaw is extreme, the aircraft may rotate for several seconds and experience negative g. Use neutral controls until recovered (rotation stops). Total altitude loss in an extreme departure can be as much as 1500 ft".

MEO Sect IV Page 7 — Add the following under fuel systems - "do not use fuel additives (such as fuel deicer) unless their compatibility with fiberglass/epoxy has been verified.

VARIVIGGEN NEWS - by Mike Melvill

I flew N27MS to Oshkosh this year and had a super trip, flew in formation all the way there and back with a 180hp Grumman Tiger, piloted by Sally. The Viggen had to be flown at quite a low power settings in order to stay with the Tiger, at ground speeds around 140

knots (162mph). I only burned 7.8 gph average for the whole trip. Not bad for 180 hp.

We flew from Mojave via Las Vegas Nv, Provo Ut, Scottsbluff Nb, Rochester Mn to Oshkosh. The Viggen joined up with the Defiant and Long-EZ for several airshows during the week. From Oshkosh Sally and I flew (Tiger and Viggen) to Indiana to visit family and then via Coffeyville Ks, Tucumcari NM, Abq NM, to Mojave. It was a most enjoyable trip. I put 37 hours on the Viggen, she now has 366 hours and apart from adding 2 quarts of oil she required no maintenance. The only new Viggen flying since CP 21 is a French VariViggen, built as a flying test bed for the Microturbo jet engine. This very beautiful aircraft is powered by two of the diminutive jet engines (same as BD5-jet) located one above the other. The aircraft has only flown a few times, but reportedly is quite fast.

Unfortunately, since CP 21 there have been two VariViggen accidents, see page of this newsletter. Although causes are not known for sure, pilot proficiency still appears to be a problem. You must be current and sharp in several airplanes before attempting a first test flight in any new airplane. Do follow the owners manual to the letter. Do not omit the high speed taxi, and runway flights. If possible, get a checkout in a Viggen with an experienced Viggen pilot. All of you are spending several years and several thousands of dollars; don't throw it all away with careless flight testing.

I have a hunch that several Viggens are almost flight ready. When you are, give us a call, we will be glad to help you with your test program or provide a Viggen checkout. I have only heard from a few Viggen builders, one Bertil Forner of Stockholm, Sweden, (see photo) reports good progress and has the basic airframe complete and is working on landing gear and control system. Russ MacMillan of Abbotsford B.C. Canada, reports that he is progressing slowly but surely, as do Frank Stites of Wayland Ma and a couple of builders in Texas.

VIGGEN BUILDING TIPS - When rigging your ailerons, be sure to set all belcranks at the fuselage stations shown on page 40 (1st Edition) and pages 46 & 47 (2nd Edition). Clamp AB4's and AB8's at the angles shown. The fabricate AB1's to AB10's to fit. This must be done correctly. It is possible for stick to lock over center if the belcranks are rigged at the wrong angles.

EXHAUSTS - The standard VariViggen exhaust system must be tied together and to the crankcase, in order to reduce the possibility of the pipes cracking. This has been in service on N27MS for 120 hours with no sign of a problem. See sketch. **SKETCHES OMITTED**

ACCIDENTS
Since the last newsletter there have been two VariViggen and four VariEze major accidents. An Ohio VariViggen crashed just after making a tower flyby to check an unsafe gear. Ground witness (pilot) reported an object fell off the engine then the engine sputtered and quit. The aircraft rolled sharply left nose pitched up and the aircraft struck the ground in a high rate of sink. The pilot was fatally injured.

Apparently the pilot tried to make a turn back to the runway but due to low altitude/airspeed the aircraft developed a high rate of sink and crashed before the turn could be completed.

A Michigan VariViggen crashed when the builder/pilot over-controlled in pitch just after his first take off in the aircraft. The aircraft was totally destroyed, but luckily the pilot survived with very minor injuries. The initial flights were flown by a qualified test pilot and he reported the aircraft was stable in all three axes and flew "practically hands off". Although the opportunity for a check out was available, the builder/pilot did not take advantage of it.

An Arizona VariEze crashed just after take off on its initial flight. The aircraft was destroyed and the builder/pilot received major injuries. We have requested but not yet received, more details on this accident.

A Florida VariEze crashed when the canopy came open just after take off. The pilot was attempting a 180 degrees turn back to the airport when the aircraft pitched down rolled left and contacted the ground. The aircraft was destroyed, the pilot received serious injuries.

A Missouri VariEze lost power just after take off and received major damage in the ensuing off field landing. The owner/pilot and his new bride were not injured. The engine failure was determined to be water in the fuel.

A Colorado VariEze crashed during landing approach when another aircraft pulled out in front of him for take off. The aircraft was totally destroyed, the pilot received very serious injuries. We have requested but not yet received details on the accident.

The Michigan VariViggen accident was apparently precipitated by the pitch trim change with power change. An experienced pilot made the first few flights on this Viggen and reported it to be "hands off" in all three axes, with good flying qualities.

Without the invaluable benefit of a check out, the builder/pilot made his first take off and was "surprised by the sudden rotation and immediately reduced power". Of course, due to the high thrust line, this caused the airplane to pitch up even more. He then slowly added power, but was probably slow enough to be sinking at this point, and the added power, pitched the nose down, only aggravating the situation. At this point the airplane was diving towards the ground, and as he put it, was as though the bottom of a loop, and he smoothly applied back pressure to pull out, contacting the ground, wings level, but with enough force to virtually destroy the aircraft.

Fortunately, he was not seriously injured, but nevertheless, he has lost a very beautiful airplane, that he worked four years to build. The pitch trim change with power on the Viggen is not extreme, nor abrupt, and is easily controlled. A low proficiency pilot can easily learn to compensate with the stick to maintain the proper attitude. However, on at least two instances we feel it has contributed to a serious accident with pilots who used abrupt power changes the very first time they were airborne and without the benefit of a checkout (see CP #12). What can we learn from this? Where possible, get at

least a back seat check ride from an experienced Viggen pilot, with emphasis on the pitch trim change with abrupt power changes. Particularly at slow speed, and, above all avoid abrupt power changes at low speed until your proficiency allows.

Let me describe a normal take off in my Viggen N27MS. Set half to full reflex (depending on condition, first flight only half) line up on the runway, smoothly apply full throttle with the stick held all the way back. (full aft stick). The airplane will accelerate to 55 - 60 mph and then the canard will begin to fly. As I feel the nose slowly rotate, I smoothly bring the stick forward to pin the nose at the attitude I want for climb. A few seconds later the mains break ground and I get the gear on the way up and run the reflex down to cruise position.

Now, if I maintained the stick all the way back all that would happen, would be a rapid rotation with the steepest climb you could imagine, provided the engine was running at full power, you would climb, but only at 300-500 fpm (depending on gross wt and density altitude). This is not a smart thing to do, even though it can be done in the Viggen, because the abrupt loss of an engine would leave you in a tricky position. Immediate forward stick would probably save the day, but you would have to be sharp!

When we look at the Viggen program so far, obviously we have a problem. This appears to be pilot proficiency and preparedness. Read the owners manual and this article over and over. In all cases where pilots were experienced they had no trouble with the airplane at all. However in two cases now we have seen pilots lose their Viggens on the first lift off in a pitch change with power change. While this has never been a factor for us, it apparently still is a significant factor for a low time, low proficiency pilot. In order to emphasize this, reread the complete writeup on test preparation, pilot preparation and test procedure in CP #12 Page 11. Also, if your Viggen is ready to fly, come to Mojave to take advantage of our offer to allow you to gain some proficiency in N27MS before you begin your testing.

VIGGEN PLANS CHANGES
Owners Manual additions.
Placards

CAUTION! Trim changes with power-forward stick required when power is reduced. (CP #13 page 9).

Minimum and maximum pilot weights must be placarded for the front seat e.g.

Min. Pilot wt	130 lbs.
Max. Pilot wt	210 lbs.

CARTOON OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Norm Ross' EZ at RAF, on his way Tullahoma.

The new Long-EZ - note the wide-chord low sweep wing with long ailerons.

This comparison shows the 43% more wing area over the VariEze. Canard and elevator are identical.

Ken Brock, with some of his stock of axles & prop extensions.

Norm Ross & Jerry Finigan's EZ and Grand Champion trophy.

The new Long-EZ on its first flight.

Bertil Forner, Sweden, has his VariViggen ready for cover - maybe he can get a formation photo with a Saab Viggen!

The Ken Brock nose gear crank assembly. Steel parts are cad-plated.

Wing fittings are shipped assembled.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Urethane foam/BID.epoxy additions on NASA F-15 Eagle.

VariEze pilot's bull session at Oshkosh under the shade of the Defiant.

R. Basin, France working on tool for homebuilt cowl.

Bobbi Cohen's Vanilla VariEze.

Ells Hamel with his new EZ.

George Gilmor's EZ getting her first flight by Dick Rutan. Mike Melvill providing chase.

FLASH - This following section was added just as this newsletter went to press:

VARIEZE SEAT BELTS RECALLED
When Johnny Murphy called with information about the accident in Florida, he reported that the pilot's seat belt had come open on impact. The FAA investigator also checked some other VariEzes in the area and found that with a little amount of manipulation the buckles would pop open. We went out to check our airplanes and "GASP" much to our shock ours also "popped" open, so easily in fact that we grounded our aircraft and will not fly one more flight with that style buckle. The buckle is the series E 8000 made by EON Corp (see tag on nylon strap). This buckle is identified by its "cap-over" design in which the release is activated from either end by the cap. The cap extends over the sides and in the closed position its edges are flush with the bottom of the buckle. (see photo and sketch). The problem is that when the occupant is thrown forward, parts of his body, belt, clothing, objects in pockets etc, can be pressed against these edges of the cap and force them forward. This releases the belt. To demonstrate this to yourself grab the straps of the belt and pull the assembly firmly

into your lap when your body is bent over the buckle. Our original thought was to install a "C"-channel under the buckle base that would provide a shield on the sides so the cap is not forced open in a crash. However, we are not seat belt designers and feel that a solution and replacement is the responsibility of the seat belt manufacturer. (EON). We set up a test demonstration of the problem and presented it to the president of EON Dr. Cross. Dr. Cross agrees that the buckles are defective and in fact, was already working with FAA on a recall due to inadequate tongue engagement. EON has agreed to replace all belts at no charge to the customer. We regret that this problem will result in your aircraft being grounded until replacement, but we must recommend that you immediately remove your seat belt assemblies both sides, (not the shoulder harness straps) and send them to EON for replacement. Do not send them to the VariEze distributor, send direct to

EON Corporation
2425 San Fernando Road,
Los Angeles, Ca 90065

Your replacement will be either a previous-design buckle without cap edges or an improved cap-over buckle with side shields. **PHOTO AND SKETCH OMITTED**

CP22, Page 11

VariEze

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE. The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $3500 (less engine) in about 1200 man-hours or from prefab parts and materials, costing approximately $5000 in about 800 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect, and repair. The VariEze uses the small four cylinder Continental. The Lycoming 0-235 without starter or alternator can also be used. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 22 gallons of fuel. Frontseat passengers up to 6'4" and 220 lb and backseat passengers up to 6'2" and 220 lb. can be accommodated plus a modest amount of baggage in a suitcase. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy

alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE TEST PROGRAM. The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/ components, manufacturing methods testing, and many other.

THE HOMEBUILDER SUPPORT. The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter published quarterly.		
One-year subscription	$6.75	$8.75
Section I	$139.00	$153.00
Section IIA	$19.00	$21.00
Section IIC	$21.50	$23.50
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95
Add 6% Calif resident - newsletter is not taxable.		
*U.S. FUNDS ONLY		

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound 11" x 17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, C85, C90, 0-200
SECTION IIC - Lycoming 0-235 - No accessories.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/ color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS AND PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP @ GROSS WEIGHT

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	570 lb
Gross Weight	1050 lb
Range @ Max Cruise	700 mi
Range @ Econ Cruise	850 mi
Landing Speed	70 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6' square feet
Canard Span/Area	12.5'/13' square feet

SPECS AND PERFORMANCE WITH 75-HP CONTINENTAL

Take Off	1200 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	550 lb

Gross Weight 950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS

ALL RAW MATERIALS

AIRCRAFT SPRUCE & SPECIALTY CO	WICKS AIRCRAFT SUPPLY
201 W. Truslow Ave. Bx 424,	410 Pine,
Fullerton, Ca 92632	Highland, Il 62249
(714) 870-7551	(618) 654-7447
Catalog $3	Catalog $2

KEN BROCK MANUFACTURING, 11852 Western Ave. Stanton, Ca 90680 (714) 898-4366: Prefabricated components - wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

THE AIRPLANE FACTORY, 7111A Brandtvista, Dayton, Oh 45424 (513) 845-9872 or 233-7754 - Canopy. Send SASE

VARIVIGGEN

PHOTO OF STANDARD VARIVIGGEN AND SPECIAL-WING VARIVIGGEN OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take Off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft Stick	49 mph
	Landing	500 ft
Performance with 150-hp. Special Performance Wing	Climb	1000 fpm
	Cruise	158 mph
Specifications Standard VariViggen	Canard Span/Area	8ft/18.3 square ft
	Wing Span/Area	19ft/119 square ft
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications Special Performance Wing	Wing Span Area	23.7ft/125 square ft
	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh 72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA SAE, AOPA, AND AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43kts) it will still climb 500 fpm roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the

Omni Aviation safety trophy at Oshkosh '73 and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips". Gas service and other airport services have been better too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION.
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS.

AIRCRAFT SPRUCE & SPECIALTY CO. 201 W. Truslow Box 424, Fullerton, Ca 92632 (714) 870-7551
VariViggen spruce kit, plywood kit, hardware, all aluminum and fiberglass. Catalog cost $3.

KEN BROCK MFG. 11852 Western Ave., Stanton, Ca 90680. (714) 898-4366.
VariViggen prefabricated components: all machined parts. Catalog costs $2.

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave., Dayton, Ohio 45424. (513) 845-9872
VariViggen plexiglass canopy

BILL CAMPBELL Box 253 Phelan, Ca 92371
VariViggen brackets and fittings.

MONNETT EXPERIMENTAL AIRCRAFT INC., 955 Grace St Elgin, Ill 60120 (312) 741-2223
VariViggen molded fiberglass parts.

GOUGEON BROTHERS, 706 Martin, Bay City, Mi 48707
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS 4102 Twining, Riverside, Ca 92509
VariViggen welded nose and main landing gear. 1-1/4" sq. steel tube.

JESSE WRIGHT (VariViggen builder) 7221 S. Colorado Ct. Littleton, Co 80122 (303) 771-5140
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8" x 10" glossy

photo and current issue of newsletter. Price - $10.00 first class mail, $11.50 Air Mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook i including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price - $6.00 first class mail, $7.50 Air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, and flight reports as possible. Details mandatory, desirable, and optional changes to plans and to owners manual. A newsletter subscription and back issues starting with CP#19 are mandatory for those with VariViggen under construction. Identifies new material sources as they become known. Published quarterly. Price - $6.75 per year first class mail. $8.75 per year air mail overseas. Back issues, $1.50 ea.

VARIVIGGEN PLANS - SECOND EDITION. This is an updated, revised set of very complete drawings and construction manual consisting of a bound 11" x 17" book, containing many photographs, hints and instructions based on actual builders experience over the part several years. It covers the entire airplane, including the engine installation fuel system, and not only covers the original standard wing in both aluminum and foam an fiberglass composite, but it also includes the composite S.P. wing, ailerons, and rudders. The manual identifies sources for all required materials and all available prefabricated parts and components. Price - $165.00 first class mail, $177.00 Airmail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18% - size radio controlled model airplane built and flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment and engine in the .35 to .65 cu inch size. 555-sq wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines) Price - $475 first class mail, $5.50 air mail overseas.

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Note! Price increase for the Canard Pusher Newsletter. This is due to the higher costs of the paper, printing, and builder support. This is our first increase since CP#1 in 1974.

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 23. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 23. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 23. If you are building a VariEze from the 2nd Edition plans, you must have newsletters 16 through 23.

A current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 Monday through Saturday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed your reply.

RAF ACTIVITY since the October '79 newsletter has involved:

(1) Final modifications on the Long-EZ.
(2) Completion of Long-EZ flight tests
(3) Development of new equipment and production method for manufacturing Long-EZ/VariEze landing gear.
(4) Manufacture of new tooling for Long-EZ VariEze landing gear, cowling and other prefab fiberglass parts.
(5) Setting a new worlds distance record with the Long-EZ.
(6) Preparation of drawings for the Long-EZ
(7) Production of Long-EZ/VariEze nose and main landing gear struts.

NEW VARIEZE OWNERS MANUAL The second edition of the EZ manual is over two years old. We have just updated it to a third edition. The third edition includes all the newsletter additions since November 1977. We recommend the new manual for all your VariEze flyers unless you have been complete in writing in all additions.

LONG-EZ PLANS The Long-EZ plans have our number one priority now and Burt and Mike are burning the midnight oil to try to get them out as soon as possible. Considering what is left to do - - typing, proofing, layout, and printing, the best guess is not later than the middle of March.

We are taking names for a mailing list for those who are interested in Long-EZ/Plans. We should have a flyer in two/three weeks which will give the price and availability of the plans. If you would like to be notified, send a self addressed stamped envelope. **CARTOON OMITTED**

VARIEZE/LONG-EZ PREFAB MOLDED FIBERGLASS PARTS
Last newsletter you were told that the new fiberglass manufacturer (for cowlings, nosegear box and strut-cover) would be in production by mid December. There has been at least a 6 week delay in this schedule, due to our failure to obtain our tooling from the previous manufacturer. Our dispute concerning transfer of this tooling appeared to be one that would take considerable time, and result in the non-availability of these important prefab molded parts. So, in November we at RAF undertook the job of manufacturing a completely new set of tooling. This allowed us to incorporate some improvements.

(1) The strut cover was deepened to accommodate both the old and the new (deeper) nose gear strut.
(2) Additional size was added to the Continental cowl where some builders have had interference with the top spark plugs.
(3) Additional size was added to the bottom of both the Continental and Lycoming cowls where clearance with exhaust system bends is marginal.
(4) The lower bumps and entire upper mold-lines of the Lycoming cowl were reduced in size and recontoured to reduce aerodynamic drag.
(5) The Lycoming oil-check door depression was made to accommodate a single-contour aluminum door.
(6) The cowl ribs were extended to seal the cooling air leaks at the trailing edge.

The new tooling was completed in early January and we are currently evaluating several bids from fiberglass shops for manufacturing these parts. We are attempting to get these made at as low as possible prices consistent with acceptable quality. We should have the new manufacturer identified, including price and availability schedule, by the time this newsletter reaches you.

FLASH - As this newsletter is going to print the new fiberglass vendor has been identified. The parts will be available through Aircraft Spruce and Wicks Aircraft Supply - see the flyer in this newsletter for addresses. Contact them for price and availability schedule. The new parts are CI - Cowl Inlet, NB - nosewheel box, SC - Strut cover, CLR - left cowl rib, CRR - right cowl rib, CCT - top Continental cowl, CCB -

bottom Continental Cowl, LCT - top Lycoming cowl and LCB - bottom Lycoming cowl. Later, we will add wheel pants and prefab Long-EZ fuel tanks.

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LONG-EZ - THE WHOLE STORY

In late 1978 we at RAF were addressing the enormous task of development and certification of the twin engine Defiant. Knowing that once started, that job would preclude further work on homebuilts for some time, we took a look back at the VariEze status to see if it was really what we wanted to market over the next several years. After accessing what was occurring with a large number of EZ projects, we decided to put the Defiant on the shelf for a while and develop an improved EZ that would solve some remaining problems. The EZ, designed around the A-75 Continental, is generally tailheavy when using an 0-200 with alternator. Also, a large number of builders were being forced into using the 0-235 Lycoming engine because of the high price and scarcity of the Continentals. Even with no engine accessories, their EZ is tail heavy and overweight. They desire electrical systems and need a greater useful load.

We decided to design a new aircraft around the Lycoming 0-235 with starter and alternator. It would have unusually long range, thus the name "Long-EZ". It would have good forward visibility on landing and a lower approach and landing speed than the VariEze, making it more suitable for the low-proficiency pilot and shorter airfields. The original configuration of the Long-EZ used VariEze wings placed out on a centersection spar that was 4 ft longer than a VariEze. The wings were swept more than a VariEze to support the heavier engine. It had "Rhino" rudder on the nose and no control surfaces on the winglets. That aircraft 79RA, was built in four months in the spring of 79 and made its first flight on June 12 '79. It did not fly well. Directional stability was weak. Dihedral effect was excessive. Adverse yaw was high. Roll rate was sluggish. Early airflow separation on the wing caused pitch instability at low speeds. The stall speed was too high.

During the next five weeks, N79RA made 51 flights, testing the effects of over 30 different modifications. Modifications included many configurations of wing leading-edge cuffs, wing fences and vortex generators. The winglet "cant" angle was changed. The ailerons were rigged to various neutral positions. Some of the changes resulted in improvements in pitch stability and lateral-directional flying qualities.

However, we were unable to improve the stall speed, landing attitude and roll rate to a satisfactory level. By August we were convinced that to get the Long-EZ we really wanted, we would have to build an entire new aft wing. The new aft wing, first flown in October '79, had the following improvements:

(1) Less sweep
(2) More area
(3) A new Eppler airfoil similar to that on the Defiant.
(4) Longer ailerons.

(5) Improved winglet juncture to eliminate airflow separation at wingtip.
(6) Overlap-type wing attachment to centersection spar, allowing incidence adjustment and eliminating the expensive fittings.

The new wing performed excellently in test. Approach and stall speeds were lowered. The lower approach and landing attitudes allowed "full stall" landings with good runway visibility. Roll rate was superb. Directional stability was still weak and rudder power at the new lower landing speeds was inadequate. We then built new, larger winglets with rudders and removed the "Rhino" rudder from the nose. That configuration completed flight tests in December '79 with very excellent results in every respect.

It has been shown to be resistant to departure during every conceivable stall entry including tailslides. Its stability is firm even at max aft cg (obtained with a 120 lb pilot with starter, alternator, vacuum pump installed on the 0-235 Lycoming). Even though it has a wing area 41% greater than the VariEze and a 26% greater gross weight, it cruises at 184 mph at 75% - only 10 mph slower than the VariEze.

Designing an aircraft for long range also results in excellent high altitude performance. Even though the Long-EZ has a fixed pitch prop and no turbo charger, it can climb to 18,000 feet in less than 20 minutes and cruise 155 mph true at 23,000 feet at light weights. Maximum ceiling is over 27,000 feet. Its long range and up to 80 mpg per seat economy are more than welcome with todays fuel price and availability.

The Long-EZ is now the recommended airplane for the 0-200 Continental and 0-235 Lycoming engines. Complete electrical systems, including starter and night lighting will be approved. The fuel system and trim system are different from the VariEze. Its 142" span canard and elevators are identical to the VariEze. We will be recommending the VariEze only for the 75 and 85 horsepower engines and of course, still without electrical systems. We at RAF are currently preparing Long-EZ drawings for release to homebuilder by early March. Distribution of materials will be through the same suppliers as for the VariEze. Most of the prefab parts are common. The new wing attachment will not be available for retrofit on a standard VariEze.

Long-EZ flight test data will be published in future C.P. newsletters where room permits. The following table lists specifications and measured preformation of both types. The first column is the VW-powered prototype, a smaller airplane built in 1975 but never marketed.

SPECIFICATIONS/PERFORMANCE OF RUTAN PROTOTYPES

	Prototype N7EZ	VariEze N4EZ	Long-EZ N79RA
Engine	62' hp VW	100hp Cont	108hp Lyc.
Span Ft.	21	22.2	26.3
Total Wing Area Square Ft	59	66.6	94.1
Gross Weight lb.	880	1050	1325
Empty Weight lb	399 bare	585	750 with electric

Useful Load lb.	481	465	575
Weight - solo with 1 hr fuel	598	796	961
Normal fuel capacity gal.	14	28	52
Cabin Length in	95	100	100
Cabin Width in.	21.5	22.2	24.2
Performance at Solo Weight			
Takeoff Distance ft.	660	650	550
S.L. Climb fpm	1680	1900	1750
Max Cruise Speed mph.	175	196	186
Demonstrated Ceiling ft.	N.A.	25,300	26,900
Calibrated Stall speed mph.	64	60	57
Landing Speed mph.	73	69	59
Landing Distance.	N.A.	800	450
Performance at Gross Weight			
Take off Distance ft.	N.A.	860	830
S.L. Climb fpm	1100	1500	1350
Max Cruise Speed mph	173	193	184
Ceiling ft.	14,000	20,500	22,000
Range at 75% sm.	580	780	1250
Range at 40% sm.	780	1050	1970
Calibrated Stall speed mph	76	68	66
Landing Speed mph	84	74	68
Landing Distance. ft.	N.A.	1000	680

NEW FIRST FLIGHTS The following is a list of those EZs that have flown since C.P.#22. If you know of someone who should be on this list, contact us so they are included should an emergency safety advisory be necessary. If you have an EZ flying and did not get a Christmas card from RAF, contact us, giving name, address, N-Number and date of first flight.

Name	City	State
David Richter	Roselle,	NJ
Rick Himrich	San Antonio	TX
Charlie Richey	Los Cruses	Nm
John Pascarella	Milwaukee	Wi
John Koskan	Wichita,	Ks
Kev Robey	Australia	
Ray Cole	Memphis,	Tn
John Jackson	Jackson	Ms
Steve Darlington	Anderson	In
Bill Keeher	Australia	
Bill Rice	Eureka	Ca
Don Owens	Bedford	Tx

LONG-EZ BREAKS WORLD DISTANCE RECORD
At 7:27 a.m. December 15, 1979 Dick Rutan took off from the Mojave, California Airport in the new Long-EZ prototype in an attempt to break a distance record held by a Czechoslovakian since 1959. The record is distance in a closed course for piston-engine aircraft weighing between 500 and 1000 kilograms (1102 to 2204 lb). The old record was held by

Jiri Kunc who flew 2955.39 miles in a L-40 Metsa Sokal aircraft in August 1959.

When Dick landed at 5:01 p.m. the next day he had covered a distance of about 4900 statute miles, 4800.28 of it credited for the new world's distance record, pending FAI approval. The credited distance is equivalent to a straight line flight from Seattle to London, or from Hawaii to Washington D.C.

Dick's 0-235 Lycoming-powered Long-EZ was modified to carry extra fuel in two wing tanks and a 74 gallon back-seat tank. Takeoff fuel was 143.6 gallons, loading the Long-EZ 600 pounds over its normal 1300 pound gross weight. Initial rate of climb was over 600 ft per minute allowing Dick to promptly climb the heavily-laden Long-EZ to his cruise altitude of 11000 feet. His course took him 15 complete laps between Mojave Airport and the Bishop, California Airport. The entire flight was blessed with perfect weather, cloudless visibility, smooth air, and less than 5 knots average wind at cruise altitude. However, the flight included over 14 hours of darkness over a sparsely populated area requiring extra demands on the pilot for attitude orientation and navigation. The aircraft did not have an autopilot, directional gyro nor attitude indicator.

The solo flight lasted 33 hours, 34 minutes. The average speed for the flight was 145.7 mph. The average fuel flow was 4.17 gallons per hour giving a mileage of 35 miles per gallon (The Long-EZ can attain over 40 miles per gallon at its normal gross weights). Dick landed with 3.75 gallons of fuel on board - enough for an additional 150 miles, but not enough for another lap to Bishop and return.

The 108 horsepower Lycoming engine performed flawlessly despite its 1500-hour-since-overhaul condition. It burned 2.3 quarts of oil during the flight.

Note that, at 1900 lb (300 lb under the allowed maximum for C1B). The range to dry tanks was over 5000 miles. Future attempts, ie, straight line distance, can be flown at 1000 kg take off weight (2205 lb) and achieve over 6500 miles range!

Dick reported the cockpit was extremely comfortable, the only discomfort being suppressing the urge to sleep. The good speed stability allowed extensive cruising without need to monitor airspeed or altitude.

VARIEZE/LONG-EZ LANDING GEAR As noted in the last newsletter, we were required to locate a new manufacturer for the special S-glass main and nose struts for the EZ airplanes. The search for a manufacturer was difficult - the normal fiberglass production shops do not have structural roving experience and do not have the necessary ovens, instrumentation and impregnation machines needed for this work. The shops that do have the equipment and engineering capability to produce these parts are those who only make expensive aircraft components and they have bid excessive prices on these items, to cover the development costs. We were faced with either no landing gear, or a price increase.

We felt that the price of the gear, having been raised 250% since 1976, was already excessive. In early November we decided to tackle the job

ourselves - the only alternative available to provide a reasonable gear for the builders. We knew this job would result in delays in plans preparation for Long-EZ but it really was our only alternative. Within six weeks we did the following: produced patterns and tooling for the new strengthened nose and main gear, developed a new production method, built a convection oven and filament winding machine, setup a quality control process, tested a new epoxy system, and began production of the new parts.

Our new method, which winds roving and tapers it for accurate mold filling, requires less man-hours and results in more uniformity than the previous process. Thus, we are able to sell the parts for only 70% of the previous price per pound.

The new nose gear strut has a deeper cross-section, increasing its strength 20%, yet allowing use of the same NG3, NG4, NG6 and NG15A parts. A gap will exist between NG15A and the forward plate. (ditto for NG6). The new nose gear is also longer, for the Long-EZ - VariEze builders will saw it to length.

The NG-1L strut; being thicker, results in interference at the rod-end when installing NG4 and NG3. We have specified a lengthened NG4, but it will be some time before these are available. In the mean time you should trim NG3 and the strut as shown to clear the rod end. **SKETCH OMITTED**

The new main gear is 65% stronger than the old VariEze gear and should not be susceptible to the long-term creep (spreading and loss of camber) experienced on some of the heavier VariEzes. The new gear is 3 inches longer on each end to raise the prop clearance on the Long-EZ. VariEze builders using the new gear will saw off the 3 inches. The old main gear weighed 16 lb. The new one weighs 21 lb. While we regret any increase in empty weight the experience has shown that many VariEze are being operated heavier than expected and need the extra beef in the gear.

We have completed Chapter 18 of the Long-EZ plans - 4 pages plus a new A5 drawing, that details the installation of the new main gear-to-fuselage attachment. This is a new, wider-stance arrangement that mounts a permanent steel tube on the strut and provides accurate gear installation using one large through-bolt per side. Since several VariEzes have experienced attachment failure due to gear vibration and rough terrain, we have incorporated a considerable amount of extra beef in the new attachment, making it more than twice as strong as the present design. Since many have expressed the desire to install the Long-EZ gear or the Long-EZ gear attachment configuration in their VariEzes, we have printed the Long-EZ Chapter 18 separately and have added an extra page detailing how to install it in a VariEze. This package, called "VariEze Installation -- Long-EZ gear" will be included in VariEze plans, sold after 1st February 1980. If you want this package to retrofit or incorporate in your VariEze currently under construction you can order it from RAF. Price is $7.50, availability is immediate.

Prices - RAF manufactured Landing Gear.
21 lb. Main Gear part # MG1-L - $277.95
2.6 lb Nose Gear part # NG1-L $ 49.75

Prices include packaging. Nose gears can be shipped UPS. Main gears must be shipped via Greyhound bus. Shipments will be sent freight-collect. Or, better yet, pick them up here at RAF. We currently have a 4-week backlog, but expect to catch up to an on-the-shelf basis by mid-March.

CHECKOUTS/FIRST FLIGHT ASSISTANCE

We also get a lot of requests for check outs and rides here at RAF. Although we do this occasionally, it's not within our capability and insurance coverage to do so as a matter of policy. We do recommend you find a local VariEze builder/flyer and have him help you. Generally, an experienced EZ pilot will agree to do your first flight, or at least the first runway flights. This is a very good idea since he knows exactly how your aircraft should fly.

B.B. Williams of 9503 E. 63rd, Suite 110 Raytown, Mo. 64133 has offered to provide a VariEze check to any one about ready to fly. If any others are willing to do this, contact RAF and we will list you in the next CP. For you VariViggen builders, Mike Melvill here at RAF will provide a Viggen check out for those Viggen builders who have their airplanes completed and ready to fly, provided their pilot experience is current. We recommend each of you take advantage of this if at all possible.

VARIEZE CHECK OUTS/FIRST FLIGHTS

In the past we have done considerable preaching about initial flight testing and pilot checkout. We talk about understanding the VariEze differences, being proficient, being current in a number of different aircraft. All these requirements/procedures are necessary and should be followed to the letter to give your "galactic wonder" every chance of surviving its initial steps toward the stratosphere. By this, we have given some the impression the VariEze is a real squirrel to fly. Not true, the great majority of first-time EZ pilots report no problems and surprise at how easy it is to fly. The reason four our preaching is that the majority of problems or accidents have occurred during the early stages of pilot checkout in cases where basic proficiency is low. (reference Canard Pusher #11 through 23).

The following quotes represent an average cross-section of comments we receive about first flights. Experience levels range from student pilot to many-thousand hour military pilots. Student pilot? Yes, Bruce Evans visited us recently on his first solo cross country trip - flying his EZ! Although Bruce has sailplane experience, the EZ was his first powered solo!

Stuart Kingman - "After three years of blood, sweat, and tears I had my own airplane! I taxi tested for two or three days just to get the feel of the airplane, and also because I was scared, and rightfully so after reading of all those experienced pilots getting killed in their EZs! All of my experience rested on 150 hours in a Cessna 150 and one hour in a Grumman TR-2. After the taxi tests, my Dad took out a $10,000 life insurance policy for me, and I lifted N222SK off the pavement and around the pattern! The feeling I had during those few moments were

completely void of any fear - it was the most fun I had ever had! The plane flew as if it had been flying for years. Absolutely no problems whatsoever. What surprised me even more was the landing. I had never flown an airplane with a stick, much less a side stick! That first landing was the smoothest landing I've ever made. Every other landing since then has also been smooth too. N222SK cruises at a true airspeed of 180 mph at 6000 ft and 75% throttle. The engine is a Continental C-90-12F turning a Bruce Tifft prop. Empty weight is 597 lb. I am extremely pleased with the airplane. I have never flown a plane even similar to it. Like I've said many times before, it flies like a airplane should". Stuart is 18 yr old.

Bob Woodall - "Just a quick note to say that I flew N301RW, on July 4. Should have written before - but have been very busy getting in the 25 hours and fixing minor items. Had the 25 hour flight test program completed 16 July. No major problems. She trims easily - very solid at cruise - starts to roll back and forth undamped at 60 mph indicated but no problem to control".

Dan Hogan - "Add another EZ to the list! N5846 made its first flight with Bob Ohletsz's EZ flying chase. Ten hours logged so far - no problems. Thanks for an outstanding design. Quite a change after flying an Ercoupe for 8 years. P.S. There are seven EZs now at Chino Airport".

Lee Roan - "Made first flight on October 21 - something I had not planned to do that day as I had not flown much in the last 5 or 6 months and had not yet had the planned Yankee checkout. I made a high speed taxi, got to 70 mph with nose wheel off then was flying. Pulled throttle back but floated past the half way mark still floating. Decided it was time to fly. I took off and flew around the field and came in too fast the first time so I went around and made a good landing the next time. The plane flies good and I have no problems with it".

Jack Day - "Bill Rogers flew my first flight - first EZ he had flown with cuffs. Says low speed stability is fantastic. Needs more pitch trim".

Norm Ross - "The VariEze is a pleasure to fly".

Dr. James Wright - "My VariEze was easy to fly from the first, even on that first flight after getting over making a fool of myself in a way I would have thought impossible (took off without latching canopy - safety catch caught it). If you fly the aircraft it is a dandy little ship with no real problems at all, that I can see. It has been flown by three other pilots - all report same (two are TWA instructors). I'm pleased with and proud of N26JW - Thank you for a good design and fine support program. When an EZ pilot goes into a new airport he is, indeed a celebrity".

Dan Lee - "After flying experience I can say that my original faith in Burt's design has been justified. It's a remarkable homebuilt".

Jennings Chestnut - "It flew well, no heavy wings etc. I have to adjust pitch spring tension, but outside of that its ready to go. I am real proud of the plane".

Don Youngs - First flight scared him - pitched up and down and did not seem to climb. Made first flight with long canard, narrow elevators and turbulent air. Made both modifications and now reports" "absolutely perfect. Requires a tad of rudder trim and that's all. Very happy with it".

Roger Klemm - "First flight was GREAT! I personally think you have overrated the EZ's "different" handling characteristics. The docile nature of the first flight was wonderful and that was due to all taxi testing and runway flying I did".

J. Steechen - "I'm sure you are tired of excited first time fliers but it did fly great, once I got used to the trim. Thank you for the outstanding builder support".

Jeff Danes - "First flight per the book. Instructions were perfect".

James Langley - "Accelerated to 80 mph, reduced power & lifted off. Everything seemed good so reduced to idle and it settled back to the runway. No problems. Back on the active, repeated the first but brought power back up after lift off. I was off and climbing at 100 mph - after several trips around the pattern approach was made at 100 mph, near approach end power to idle settled on the runway at 80. Wow! what a thrill it is!".

Bob Hudgins - "Straightened out the weight and balance and now it flies and handles great. I really love the way it handles even in gusty and crosswinds I've had no problems" (Bob initially damaged his EZ trying to fly it with cg too far aft).

Tom Bradford - "Your test preparations and procedures were followed and everything worked beautifully. Thanks for 2 years building fun and fantastic very easy VariEze flying".

Rich Clark - "Lift off surprised me. Continuing acceleration with the stick slightly back is a lot different from stabilizing speed with the nose held down. - - - I tried mentally to freeze my hand and succeeded in a series of damped pitch oscillations during initial climb. Roll/yaw ok. I let out a Texas yell, wiggled the wings for the congregation and settled down to trim out. Descent and approach were smooth. Love those ailerons. Over the numbers at 80 knots, overflared up to 20 ft, and another series of pitch oscillations. Eventually E-Z-GO got tired of the comedy and sank to the runway. The solid rumbling of gear on runway and straight rollout were reassuring. Why could I not drive it on? Main factors were pitch sensitivity and Cessna training. Also, confusion with left hand throttle where up is go and down is slow - - Later - - feelin' at home expanding the envelope. Sure enough, won't stall, just nods. Heavy back pressure at low speeds. Easy to locate traffic up here in the bubble. High on final, I ease back to 70 knots to below glide slope. Ease power on to hold it. Good flare and soft rumble and I'm at jogging speed". "Had a lot of confidence before I had flown it, now I have much more".

Steve Darlington - "I can't put into words how much fun it is to fly an aircraft that I built myself. I always get so excited before and after each flight that I usually forget all the flying data. (Now I write it down!). The VariEZE is extremely eze to fly and has very normal flying characteristics being a little more sensitive in pitch than in roll. Ailerons are not as effective as expected but with a little rudder they come alive. The stalls seem to be non-existent at the present time. At full aft stick 1500rpm 55 mph indicated she's still flying with only very small buffeting and all controls still effective. I have had it up to 178 mph indicated at 7000 ft full bore, 2800rpm (195 mph true). A little rpm goes a long ways in the airplane. My EZ is VariEze to land especially with its built-in attitude indicator. (nose canard). If you can't see the runway the nose is too high. Holding the nose off after touch down really slows her down and eliminates heavy braking. Touch and go's are fun since the nose gear never touches the runway.

Gion Bezzola (Swiss Airforce Instructor) - "After putting the plane together and carrying out a comprehensive pre-flight check, according to the American Handbook, I did two taxi tests with the nose up, and another with about 30% power to test the elevators and to get used to them. The nose allowed itself to be lifted from the ground at about 50 mph, and to be held there. The VariEze began to dance about on it's toes as if she couldn't wait to get into the air. I wished to remain captain in charge, so we stayed on the ground a while longer to test the steering. The direction of flight had to be retained with the brakes up to about 30 mph, and above that, the rudder was sufficient. I had to remember to bring my feet back when I wasn't using them, otherwise I would have inadvertently used the brakes. The acceleration was very good. We were very excited before the first lift-off, but this was carried out with no cause for alarm. The wings were flat, the stick was exactly in the neutral position. I got used to the lateral position of the stick very quick and then the Eze was flying, one meter above the ground down the runway. I held the speed at about 80 mph. I decelerated by throttling down slowly, lowered the plane and landed like a feather. The steering felt finely balanced and the brakes were adequate. The first part of the test program, awaited with bated breath, was completed. After four more short flights at a height of 1-2 metres, the inspectors from the Air Ministry arrived and then I was ready for the first big flight of HB-YBG.

The five short flights, the taxi tests, the performance of the engine and the faultless work that the builder had done, gave me a lot of confidence in the machine. We worked out that the center of gravity lay in the allowed area when I was wearing a parachute. The motor was running quietly, and so I asked for starting permission from the Tower. That moment was here again - the first big flight in a new plane, a fantastic exciting moment. I had already experienced such a moment in 1977 when I test flew my own construction the Lutibus, HB-YAY, and now I was looking forward to it again, even though my mind was full of concentration. I opened the throttle, lifted the nose at 50 mph, at 70 mph I lifted the Eze from the runway and held the resulting angle of climb. The angle of climb came as no great surprise to me - I, as a jet-fighter pilot, am already used to such a steep angle of climb! But the fact that this was a home-built machine, powered by only 90 hp, that was a fantastic surprise.

We, the Eze and I, had hardly started, and already I was crazy about her. The steering reacted marvelously, and I trimmed it out with short blips on the electric trim switches. I had to keep watching out that I didn't exceed the permitted maximum speed for a wheel-out flight, because the plane kept wanting to go faster. The Eze was a real little thorough bred! The air-brake worked very well when it was out, and showed this by slightly noticeable buffeting. I realized something pretty quickly: this was probably the most phenomenal plane that I had flown, and I had flown forty different types, Mirage and Hunter included!

After about twenty minutes, I carried out a simulated touch and go, and could judge my imagined landing point very well, a fact that was later supported by the actual landing. On final, at about 90 mph, then over the beginning of the runway with about 80 mph on the clock, the Eze was landed with enough pilot visibility. I landed the Eze and held the nose up in order to brake aerodynamically. Rolling down the long runway gave me time to savor the thrill of the that first flight. I was also pleased for the builder of HB-YBG, who had, through his extremely clean work, given me one of the best flying experiences of my life.

The loud 'hellos' from the spectators who had gathered in the meantime, the happy smile of the builder Rudi Kurth, the congratulations from friends and from the officials of the Air Ministry, was payment enough for the preparation made for this flight, that was threatened at no time by an uncalculated risk. The knowledge that the VariEze constructor, Burt Rutan, knew exactly what he was recommending to future Eze pilots through the handbook, proved to me that a very conscientious pilot was the spiritual father of brand new type of plane. This knowledge grew stronger as the days past, especially when I took the Eze through the stall test, and through the largest part of the tests. How many crashed planes and their pilots could have been saved had this type of plane been designed earlier, because the behaviour of the Eze in extreme conditions is simply fantastic. That a plane can still fly controlled turns when it is stalled, and climbs with full throttle, without the slightest danger of a spin is a wonderful performance of modern aerodynamics.

The manufacturers of conventional planes will have to think again if they wish to equal this type of safe flying. The influence which the VariEze will have on general aviation cannot yet be judged, but I have the feeling that it will be a great influence. After the first flights, I was sure that Rutan had not promised too much. The plane which Rudi Kurth had built was exactly according to the specifications which could be found in the handbook".

Steve Stuff - "First landing like all since then, was very easy, due no doubt to the ground-effect flights. Quite maneuverable, very safe and loads of fun".

LBF RACE 1980 Just a reminder that we are still active in organizing the VariEze class within the LBF race this year at Oshkosh and are expecting a large VariEze turnout. (see C.P. #22 page 1). We are working with the sponsors for the prize money. It will be worth the effort so start planning now. Final details in C.P. #24. See C.P.

#22 and December '78 Sport Aviation for rules. Also, we have decided to allow Long-EZs to compete with VariEzes.

If you as a company or individual would like to help promote this efficiency race by providing a prize/cash for the winners, please contact us before mid March.

CP23, Page 5

SAFE-T-POXY WORKING TEMPERATURE Builder feedback has indicated some difficulty using the Safe-T-Poxy in cold climates. Typical situations are where most EZs are built in garages that are difficult to heat in the winter. Problems are where the builder will heat up the room/garage (air only) and go directly to work but the epoxy, glass, parts, tools etc are still cold-soaked. In use, cold epoxy wets slow and greatly extends the time to wet the cloth properly. The Safe-T-Poxy has a higher viscosity than the previous resins, thus requiring a higher working temperature to use, especially on the larger lay ups. The high viscosity was selected for the Safe-T-Poxy to eliminate the tendency of the previous material to bleed-out (inducing air in the lay up during cure). If you are building in a cold garage in the winter you can still use the new Safe-T-Poxy if you take the following precautions:

(1) Warm the resin and hardener evenly to 85-90 degrees F prior to mixing. Don't try to hurry this. We use a light bulb under the ratio pump 3-4 hours prior to use, or keep your resin jugs in a cabinet with a light bulb inside.

(2) It's important to have everything thoroughly warm prior to starting to work. This also cannot be rushed. It takes time to get the parts (wings, foam blocks, etc) up to a stable temperature through out. If you are starting from a very cold garage the warming process could take 4 hours or more. Don't think just because the air is warm that all the material is warm.

(3) Use an electric hair dryer to warm the area as you work, being careful not to overheat the part or epoxy. When, due to cool temperatures, a part is slow to wet out, a few quick passes with a hair dryer will greatly speed the lay up time. Do not use a hair dryer to heat a cup of epoxy. This can give local hot spots and ruin pot life.

What shop temperature is satisfactory? That has a lot to do with the size of the job. Small jobs can be worked to as low as 65 degrees F but the working time will be excessive. It will also be more difficult to remove excess epoxy, resulting in a heavier part. On large lay-ups like the fuselage, wings, etc, where there is a lot of epoxy to drag around, 77 degrees F should be considered the minimum. That's epoxy prewarmed to 85-90 degrees F and all parts, glass, foam, tools, table -- everything up to 77 degrees F for 4 hours then go to work. Those temperatures are minimums - add 5 to 10 degrees F and your working time will be greatly reduced and parts built lighter. Optimum working temperature range for the current Safe-T-Poxy is 85-95 degrees F. We realize that this is higher than desired, thus we are now working with the formulator, testing improvements. These will be incorporated -

however, by the time the pipeline is filled the cold season will be over.

Safe-T-Poxy is sold in 1 1/2 gallon kits. The price is the same per gallon as the previous resin.

POSSIBLE STROMBERG CARB PROBLEMS Ray Cole from Memphis, Tn. reported to us that he had two engine failures on his first two flights just after take off and has attributed the problem to the original Stromberg carburetor on his C-85. Both forced landings were without damage, which is extremely lucky considering they involved turning back to the airport from only 200 ft altitude! After extensive trouble shooting he determined the climb angle resulted in an uncovered jet in the carb, although this could not be simulated on the ground. He replaced the Stromberg with a Marvel Schebler carb and has had no problem. We here at RAF have no experience with the Stromberg carb and thus could not offer any solution. If anyone out there has had any experience with this carb and could enlighten us please contact us and Ray Cole at 4948 Clear Brook Cove, Memphis, Tn 38118

RESIN/HARDENER STORAGE
(1) Never keep your resin/hardener in a cold place. Even for long term storage. It should be stored at room temperature. If you see your resin start to crystallize and settle out, it's important that it be returned to its normal state as soon as possible even if you don't plan on using it right away.

To return crystallized or separated resin to its normal state put the jugs of resin in hot water 160 - 190 degrees F until the resin clears. Be patient this could take several hours. Occasional mild agitation/shaking will accelerate the process. Leaving the resin hot for 3-5 hours after it clears will reduce its susceptibility to recrystallize. If, after 5 hours at 160-190 degrees F your resin is not clear, return it to the distributor.

VARIEZE SEAT BELT RECALL UPDATE
Reference CP 22 page 11 EON 8000 seat belt buckle recall. We have learned that some of the recalled buckles are being replaced with an improved version of the same 'cap over' design. We found EON is doing this because they had nothing else to replace them with at this time. The improved design has the side edges of the cap trimmed up higher, rather than extending down to flush with the bottom and has the words "lift to open" on the cap. Our tests of the improved E-8000 show that it does not pop open as easily as the previous one. However, if it is placed on the side of the lap over the leg and the body is thrown forward, it can still release - particularly if it snags on your belt or is pressed against an object in a front pants pocket. It is more susceptible to release if it is loosely, rather than tightly, adjusted in your lap. Thus, in our opinion this buckle is not satisfactory.

We just had a meeting with EON and have concluded that the E8000 still requires further modification before it's airworthy. We are very encouraged that EON is willing to redesign and replace the buckle with one that acceptable. However, redesign, tooling, manufacture and delivery will take time. So an immediate solution to those of you that are grounded is not available right now from EON. Those who are

waiting for a buckle replacement should consider an alternate until EON can supply you with an acceptable belt.

Our recommendation to those who have received the "improved" buckle is to conduct your own test - hook the belt to the back of a chair and throw the body forward.

Evaluate for yourself the effects if any protrusion in your lap area coming in contact with the belt side edges - including a pants belt buckle or keys in your pocket. If you agree that there is a problem, write a letter to EON and to FAA describing your concern.

EON Corp.,
2425 San Fernando Rd.,
Los Angeles, Ca 90065

FAA AWE-130
Attn: Fred Jenkins
15000 Aviation Blvd
Lawndale, Ca 90260

RUDDER TRAVEL In CP #22 Page 8, we issued a Mandatory Grounding bulletin that reduced rudder travel from 3.5" to 2.0". To do this it stated that the cable is cut and shortened. However, due to a missing sentence, it didn't tell which cable to cut. The correct cable that should be shortened is the 3/32" cable that runs from the top hole of VECS 15 bellcrank up to the brake cylinder arm (ref page 16-2 of the plans). Also note that the repeatability of the stop, (rudder out to only 2") depends on the condition of the brake master cylinder. If it leaks or bleeds down the amount of maximum rudder travel will increase. Keep your VariEze brake system in top shape, it's your only means of directional control under about 30 mph speed. What ever you do, don't put any other stop in the system or you will find yourself without brakes.

The rudder deflection bulletin is being repeated in this newsletter with the clarification.

URGENT CONTINENTAL ENGINE DIRECTIVE We had a report of a VariEze Continental 0-200 engine failure due to oil pressure loss. Teardown inspection of the engine found that some of the needle roller bearings out of the starter shaft support found their way into the oil pump, causing considerable mechanical damage. The starter's shaft on some models is supported in the accessory case by a small (.5" dia) needle roller bearing that is pressed into the engine case. When the starter is removed as is the case for VariEze use, this bearing remains in the engine. If the bearing races are worn, the rollers can fall out and then destroy the oil pump or other components. Not all Continental engines have this bearing, some have a pinion pivot. But in any case, each aircraft with a Continental engine that is operating without a starter (normally the starter shaft holds this bearing in place) should immediately be grounded until the following inspection/modification is accomplished.

Pull the starter cover plate on the top of the accessory section and with a mirror and flashlight determine if your engine has this open roller bearing. Be very careful not to drop anything down in the case or you will be faced with an engine removal and teardown to remove it.

The open needle bearing must be removed or "plugged" to prevent the rollers from falling out. We did not have a puller adequate to remove the bearing, so decided to use a plug. The plug is a 1/2" diameter shaft inserted in the hole taking the place of the starter shaft. Refer to the adjacent drawings. Drill and tap a 10-32 thread in the starter cover plate at the location shown. Cut a 1/2" diameter aluminum rod to a length of 3.15". Drill a 3/16" (#10 drill) hole through the center and bolt it to the cover plate with an AN3-34A bolt and AN960-10 washer under the bolt head. Safety it with a MS21042-3 lock nut on the outside of the cover plate. This assembly then inserts into the needle bearing, providing retention of possible loose rollers. **SKETCHES OMITTED**

AEROBATICS We often get asked "is the VariEze aerobatic?" Answer "No". The VariEze was not designed for aerobatics and the flight manual states they are not permitted. Long range cruise efficiency was the design goal rather than any aerobatic capability. Those who want to do aerobatics should consider an airplane specifically designed for aerobatics. Recently Dick and Burt had an opportunity to fly Richard Grunsven's new RV-4 and thoroughly enjoyed it. The RV-4 is an excellent acro aircraft and would recommend it to those who want an aerobatic aircraft.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft Do not fly until the change is been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

VARIEZE PLANS CHANGES

DES Sect III
Page 3 Connect a 6 volt bulb across the two leads to the roll trim servo motor.

MEO Sect V
Page 1 Caution. Never use any (Chemical) paint stripper or solvents on your aircraft fiber glass structure. These materials may not be compatible with the epoxy and damage the basic structure or penetrate the fiber glass and destroy the foam underneath.

MAN-GRD Sect I
Page 19-12-Repeated with clarification from
Sect IV C.P.#22.
Page 28 Rudder Travel - Mandatory change before next flight. Reduce rudder travel from 3.5" to 2.0". This can be done by shortening the vertical cable that runs from the top hole of VECS15 up to the brake arm. Make fine adjustment with the fitting on the top of the master cylinder. The rigging check takes two people - one in the cockpit pushing full rudder pedal

deflection and one measuring at the top of the rudder while applying a mild aft airload (about 3-5 lb) on the rudder trailing edge.

MAN-
GRD Sect IIA Page 1 Sect IV Page 29 Continental engines operating without starter - inspect for open needle bearing. Remove or plug bearing per this newsletter to avoid possible engine damage.

OPT Sect I Page 17-6 You can substitute a HM-6C with a steel insert to 1/4" dia. in place of the RE4M6 rod ends. (suppliers are having trouble getting the RE4M6).

ACCIDENTS In December an Australian VariEze crashed just after take off fatally injuring its owner/pilot. The information we have received to date is sketchy at best, but what appears to have happened is that the pilot made a normal take off to about 20 ft AGL then dove back to the runway hard enough to hit the prop and wheel brake discs. The aircraft then pitched up nearly vertical (70 degrees), rolled inverted and crashed from about 100 foot altitude. This was the pilots first flight in the aircraft.

The aircraft however, had flown 5 hours by a competent pilot, had completed its basic tests including stalls and found to be normal. The accident is still under investigation. If any significant finding is received, we will pass it on.

NEW VDO ENGINE INSTRUMENTS In newsletter 22 we listed a new line of engine instruments we had been testing in the Long-EZ and were very happy with. We also stated the oil pressure indicator could also incorporate a low pressure warning light and run the hour meter only when the engine runs. The following is the wiring-diagram for both the low pressure warning light and the hour meter hook up. Route the 12 volt input through the master switch and protect with a 2 amp breaker. **SKETCH OMITTED**

In newsletter 22 page 5, we listed a set of VDO/CARR instruments that we tested in the Long-EZ. We erroneously listed the cylinder head temp sender Part No. VDO 323-701. This is a sender for a small 14 mm spark plug. Unfortunately VDO does not make a sender for a standard size aircraft spark plug (18mm). However, the Westac CAT sender #712-5W is compatible with the VDO cylinder head temp gauge. Our calibration indicated essentially zero error. Just a reminder to check the calibration of any new gauge prior to use. (see C.P. 19, page 4). Remember these CHT systems are not temperature compensated. They are calibrated to 70 degrees F and read the difference between the sender at the cylinder head and the end of the thermocouple wires coming from the sender. If the air temperature is above 70 degrees F you must add the difference to the gauge reading - if below 70 degrees the difference must be subtracted. So if its 100 degrees F outside, your actual CHT is 30 degrees F more than what's showing on the CHT gauge. Most installations terminate the thermocouple sender wires on the fire

wall and run aircraft wiring up front to the gauge. In this case use the outside air temperature for the correction reference.

LIGHT WEIGHT ALTERNATOR Thanks to a suggestion by Ben Duarte from Richardson Texas. We have adapted a 10 amp Kobota tractor alternator to run on the Long-EZ. The alternator is a small, very rugged, well built unit. Unfortunately extensive machining is required to remove excess material. We have run it over 45 hours with no problems (one flight was 33.5 hours long!) The whole thing is real slick, total weight is under 5 lbs and the hookup/belt drive is very simple. Technically it is not an alternator but a dyno for it has permanent magnets and it's output is not regulated by the field current. The dyno output is constant AC and needs a special rectifier/regulator. If there is enough interest/demand for such a unit we could arrange to have a complete package put together and made available through one of our suppliers. Let us know - should be under $200 complete

OVERSEAS VARIEZE BUILDERS There can be a significant savings in the cost of shipping various items like canopies, cowlings etc overseas if multiple shipments are made (5-10 in one box). Some of the distributors will also discount multiple orders. Attempt to combine orders before contacting the distributor, if possible. If you would like to be the focal point for combining orders in your area send your name and address to RAF, we will print it in a future C.P. newsletter so that other builders in your area can contact you to arrange a multiple shipment.

HOSPITALITY CLUB ACTIVITY The club is planning a get together at Bull Head City Arizona on April 13th and 14th. Rain date is the 19th and 20th April. Camping and motel rooms will be available. For further information about the Bull Head gathering and also the Hospitality Club, contact Don Shupe, 2531 College Lane, La Verne, Ca 91750 (714) 593-1197.

Ed and Joann Hamlin hosted a Hospitality Club New Years Eve party. Seven EZs arrived to join the fun.

FLYING EZE BOOK - "Thank you all 48 who have sent me pictures and wonderful letters, great information. Now please, the other 162 please, I need your pictures etc. to complete the "Flying Eze Book" before we go to Oshkosh this year".

Burt's Mom
Mrs. Irene Rutan,
8526 Calmada,
Whittier, Ca 90605

Mrs. Rutan is the VariEze Hospitality Club historian.

VARIEZE BUILDER HINTS Fuselage - center section spar mating method. You may find it easier to skin the fuselage prior to installing the center section spar. To do this, assemble and glass the fuselage but tack the firewall on for alignment only. Peel ply the skin where the center section spar will be cut out later and around the firewall area. After cure, remove the firewall, cut out the slot for the center section spar and glass on to the fuselage peel ply area with 3 inch wide tapes of 45 degrees BID - 2 plies. Use 2 inch wide tapes lapping

onto the firewall. This allows you to skin the fuselage before building wings and center section spar.

In C.P.#22 we recommended a dual switch that shorts across the roll trim servo motor that keeps it from backing off. Since we published C.P.#22 we have received numerous suggestions on how this could be more easily accomplished. Tom Martin suggested connecting a 6 volt light bulb (available at Radio Shack stores) in parallel with the servo motor (across the two leads to the servo). You "pinball freaks" can mount the bulb where you can see it light up every time you tweak the roll trim! Two other solutions to short the motor are shown below:

Jim Eggelston suggested a single switch that does the job: **SKETCHES OMITTED**

Richard Clark and William Ruben pointed out that the C.P.#22 dual switching is simpler with two single-pole micro switches. Part # 8A1061 micro. **SKETCH OMITTED**

The "Real" George Scott, builder of the award winning VariEze N240EZ publishes a monthly newsletter that is full of builder tips and flying hints. Really great. Subscriptions are $6.00 and payable to

George Scott, Jr,
9 Chestnut Hill Rd., Rt 7,
Cummings, Ga 30130

FOR SALE

VariEze Prop - Teds used 58 x 70, C-90 engine
Alan McPherson (408) 258-4212 - $185.00

Aircraft Spruce spinner cut out for this prop - $80.00

VariViggen Canard complete except for top skin $600
Delbert D. Dester
109 Holland's Grove Lane
Washington, Ill 61571
(309) 745-8232

VariViggen engine mount. Modified from a 1963 Cherokee. $180
Bruce Olsen
137 Las Flores
Goodyear, Az 85338
(602) 932-1739

Franklin engine 2A-120-C, 2 cylinder 60 hp. 30 hours SMOH. Rebuilt bendix mags & carb with pusher prop. $1900 FOB Mojave. This is the engine out of N7EZ original prototype. The aircraft is EAA museum bound and engine is available. This engine is NOT recommended for a VariEze.
Ask for Dick. (805) 824-2645

VariEze Cassidy prop, almost new $150 for a C-85 engine.
Nat Puffer.

Evenings (612) 776-1145

Lycoming 0-235 for sale
W.E. Clark
116 West University Pkwy,
Baltimore, Md 21210
(301) 256-5671

VARIVIGGEN NEWS Not much to report this time, only a few Viggen builders have been in touch. Charles Allen is progressing very well and judging from the photos he sent, he is aiming at a Grand Championship - just beautiful workmanship, Charles. See photos. The French built VariViggen powered by two microturbo jet engines is undergoing flight test and has been featured in several European magazines. Performance figure quoted in "Avimag" are quite impressive: top speed - 248 mph, cruise speed - 198 mph, rate of climb - 1180fpm. Of course this aircraft is a flying test bed for the microturbo engines, and is not a real ideal "homebuilt" due to severe range limitations, range is only about 200/250 miles or 1 hour of flying time!

N27MS now has 400 hours on it and just over 500 landings. This means that the worm gear main gear retract system (now standard in the 2nd Edition Plans) has over 500 cycles under load on it, with absolutely no problems whatsoever. The only problems I have had have been the alternator, which for some reason or another, have failed at a rate of one every 100 hours. My alternator is a Chrysler product, standard equipment on many Piper aircraft, and is a certified aircraft part. All four failures have been different, bearings, diodes, field coil windings failed, etc. Anyway, I have decided to try a different make of alternator, and am in the process of installing a brand new Alcor (Motorola) ?? amp alternator. I intend ducting cold air onto the alternator, even though I tried that with the last Chrysler one, without much success. The Alcor has about three times the warranty so hopefully I will have more luck.

The other thing that has come up is brakes. N27MS never has had very good brakes. They have been adequate but not near as powerful as Burt's N27VV. Both aircraft have Cleveland 500 x 5 wheels, tires and brake calipers. This has puzzled me to the point that some time ago I went in and changed the pedal to master cylinder leverage ratio. This helped some, but did not give the expected results.

Building and flying the Long-EZ which has the same wheels and brakes, I was amazed at the tremendous braking power it has. Even allowing for the difference in gross weights, it was much superior to mine, so I looked little further, and don't know why I did not catch it before. What I had done was to buy a brand new set of 500 x 5 Cleveland wheels and brakes, and then because I was "cheap", I bought Gerdes master cylinders instead of Clevelands because at the time they were about half the price. it turns out that the Gerdes master cylinder piston is .625" in diameter, and the Cleveland is .562" in diameter. This does not seem like much, but makes all the difference in the world. The Gerdes wheels and brake calipers work fine with the Gerdes master cylinders, the piston in the caliper is larger and thus they work well together. However I am not positive but I believe the Gerdes wheel and brake assembly is wider and may not fit up into a Viggen wheel well,

the Clevelands only just barely fit. The moral here of course is to be sure you have compatible brake cylinder/brake caliper combination. The Rosenhaan brake master cylinder is .50" in diameter and is compatible with the Cleveland wheels and brakes, and at a much more affordable price than the Cleveland master cylinders.

Charles Allen's Viggen - note all equipment installed before skinning fuselage. **PHOTOS OMITTED**

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Bruce Evans with his EZ on his first solo cross country trip!

Long-EZ during distance record flight. Note the 74 gallon rear seat tank (450 lb!).

Three generations of EZs in formation. Long-EZ, VariEze and 60hp prototype built in 1975.

Instrument panel on the Long-EZ. The new pitch trim is on the left console, aft of the throttle. Note the large CARR Tach (upper right). Two more instruments are on center floor, just out of view.

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NASA wind tunnel data showing that winglets provide less drag than a wingtip extension that has the same bending moment. **GRAPH OMITTED**

Jet VariViggen in flight. **PHOTO OMITTED**

Oblique Wing Aircraft in First Flight
National Aeronautics and Space Administration's AD-1 oblique-wing research aircraft flew its first flight Dec. 21 and is expected to begin skewed-wing flight tests around mid-February, following a series of preliminary test flights aimed at gathering base data with the wing in a normal perpendicular position with respect to the fuselage (AW&ST Jan. 7, p. 14). The wing can be pivoted up to 60 deg. from the normal perpendicular position. Propulsion is provided by two Microturbo TSR-18 turbojets of 220 lb. thrust each. NASA is studying the application of the oblique wing concept to future high-speed transport aircraft, where the wing would be pivoted at higher speeds to reduce drag and thereby allow higher speeds and longer range for the same fuel expenditure.

RAF-designed AD-1 skew wing aircraft is now in flight test. Article from Aviation Week.**PHOTO OMITTED**

DC-100 STYLE VARIEZE MARKET SURVEY. Most of us agree it would be nice if we could carry more passengers in our VariEzes. A builder in Western Massachusetts has come up with a kit to modify your VariEze so that it will carry 310 passengers, a pilot, co-pilot, engineer and six Swedish stewardesses. The full kit including three jet engines, plans, materials, 2,500 gals resin shipped to the siding of your choice and

will probably cost $1,310,000. We would consider making the system available as a kit or fully assembled if there is enough interest.
SKETCH OMITTED

Check appropriate box:
Send plans only;
Send Kit, enclosed M.O.
Send fully assembled (6 wks)
Send Stewardesses only.
Wadayououtayourmind??!!

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VariEze

TODAY'S HOMEBUILT WITH TOMORROW'S TECHNOLOGY

PHOTO OMITTED

THE AIRPLANE. The VariEze is a small, high-performance homebuilt sportplane. It can be built from raw materials costing approximately $3500 (less engine) in about 1200 man-hours or from prefab parts and materials, costing approximately $5000 in about 800 man-hours (about eight months spare time work). Its structure is a sandwich of high-strength fiberglass, using low-density, rigid foam as core material. The structure is fabricated directly over the shaped core, thus expensive tools and molds are not required. Composite-sandwich structure offers the following advantages over conventional wood or metal: less construction time requiring less skills, improved corrosion resistance, improved contour stability, better surface durability, dramatic reduction in hardware and number of parts, easier to inspect, and repair. The VariEze uses the small four cylinder Continental. The Lycoming 0-235 without starter or alternator can also be used. The airplane has exceptional climb and cruise performance. It can carry two people 700 miles at 185 mph on less than 22 gallons of fuel. Frontseat passengers up to 6'4" and 220 lb and backseat passengers up to 6'2" and 220 lb. can be accommodated plus a modest amount of baggage in a suitcase. The airplane does not have full dual controls, but does have a backseat control stick. Due to its small size (only 67-sq.ft. wing area) it is not the airplane for installing extra equipment for IFR, night flying, etc. It can handle a simple electrical system with a single NAV COM and gyro instrument. These can even be powered with a solar panel, thus eliminating the heavy alternator. The VariEze is recommended for day-VFR operation only. Due to its relatively high landing speed (70 mph) and small tires, it is acceptable only for smooth, hard-surface runways. Its stability and overall flying qualities are superb. Once trimmed, it will hold attitude and level flight "hands-off" even in turbulence. Trim changes due to power, gear retraction, or landing brake are all very small. Its unique aerodynamic design allows it to be flown with full aft-stick, at less than 50 knots, without a stall departure or loss of control, and without altitude loss. The VariEze uses the latest aerodynamic features: NASA winglets, both wings cruise at best L/D, basic arrangement provides stall safety, stiff structure provides accurate contour maintenance, basic system's design eliminates or combines

complex control systems, which saves weight, cost and building time while increasing reliability and lowering maintenance.

THE TEST PROGRAM. The VariEze test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/ components, manufacturing methods testing, and many other.

THE HOMEBUILDER SUPPORT. The manufacturing manual is a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, "The Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

Check items desired	Price, including first-class mail U.S. and Canada	Air Mail Overseas*
VariEze info kit includes current issue of "Canard Pusher" newsletter	$5.00	$6.00
"Canard Pusher" newsletter published quarterly. One-year subscription	$6.75	$8.75
Section I	$139.00	$153.00
Section IIA	$19.00	$21.00
Section IIC	$21.50	$23.50
Section III	$8.00	$9.50
Section IV	$8.00	$9.50
Section V	$7.00	$8.00
Section VI	$10.00	$11.00
3" tri-colored jacket patch	$1.95	$1.95

Add 6% Calif resident - newsletter is not taxable.
*U.S. FUNDS ONLY

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire VariEze except engine installation. The manual consists of a 153-page, bound 11" x 17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles instrumentation, electricals, fuel, exhaust and

induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental A65, C85, C90, 0-200
SECTION IIC - Lycoming 0-235 - No accessories.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring/priming/U.V. barrier/ color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft long can be used with appropriate pilot proficiency.

SPECS AND PERFORMANCE WITH 100-HP CONTINENTAL, FIXED-PITCH PROP @ GROSS WEIGHT

Take Off	900 ft
Climb	1600 fpm
Max Cruise	195 mph
Econ Cruise	165 mph
Empty Weight	570 lb
Gross Weight	1050 lb
Range @ Max Cruise	700 mi
Range @ Econ Cruise	850 mi
Landing Speed	70 mph
Landing Distance	900 ft
Wing Span/Area	22.2'/53.6' square feet
Canard Span/Area	12.5'/13' square feet

SPECS AND PERFORMANCE WITH 75-HP CONTINENTAL

Take Off	1200 ft
Climb	900 fpm
Max Cruise	172 mph
Econ Cruise	145 mph
Empty Weight	550 lb
Gross Weight	950 lb

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS

ALL RAW MATERIALS

AIRCRAFT SPRUCE & SPECIALTY CO
201 W. Truslow Ave. Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $3

WICKS AIRCRAFT SUPPLY
410 Pine,
Highland, Il 62249
(618) 654-7447
Catalog $2

KEN BROCK MANUFACTURING, 11852 Western Ave. Stanton, Ca 90680 (714) 898-4366: Prefabricated components - wing attach assembly, nosegear machined parts, control system components, fuel caps, engine mount, rudder pedals. Catalog costs $2.

THE AIRPLANE FACTORY, 7111A Brandtvista, Dayton, Oh 45424 (513) 845-9872 or 233-7754 - Canopy. Send SASE

VARIVIGGEN

PHOTO OF STANDARD VARIVIGGEN AND SPECIAL-WING VARIVIGGEN OMITTED

Performance with 150-hp, fixed-pitch prop, gross weight. Standard VariViggen	Take Off	850 ft
	Climb	800 fpm
	Cruise	150 mph
	Full Aft Stick	49 mph
	Landing	500 ft
Performance with 150-hp. Special Performance Wing	Climb	1000 fpm
	Cruise	158 mph
Specifications Standard VariViggen	Canard Span/Area	8ft/18.3 square ft
	Wing Span/Area	19ft/119 square ft
	Empty Weight	950 lb
	Gross Weight	1700 lb
Specifications Special Performance Wing	Wing Span Area	23.7ft/125 square ft
	Gross Weight	1700 lb

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh 72.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA SAE, AOPA, AND AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43kts) it will still climb 500 fpm roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The prototype received the Omni Aviation safety trophy at Oshkosh '73 and the outstanding new design award at Oshkosh '74.

EXCELLENT UTILITY
Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. Its unusual design turns routine travel into "fun trips". Gas service and other airport services have been better too! Take it home; it's road-towable with outer panels removed.

UNCOMPLICATED CONSTRUCTION.
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in

fiberglass, ready to install. All machined parts are also available, as well as other prefab parts.

EASY TO FLY
Despite its unique appearance, the VariViggen has no unusual or pilot-demanding flight characteristics. It is easier to handle than conventional aircraft, particularly in gusty crosswind conditions.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS.

AIRCRAFT SPRUCE & SPECIALTY CO. 201 W. Truslow Box 424, Fullerton, Ca 92632 (714) 870-7551
VariViggen spruce kit, plywood kit, hardware, all aluminum and fiberglass. Catalog cost $3.

KEN BROCK MFG. 11852 Western Ave., Stanton, Ca 90680. (714) 898-4366.
VariViggen prefabricated components: all machined parts. Catalog costs $2.

THE AIRPLANE FACTORY, 7111-A Brandtvista Ave., Dayton, Ohio 45424. (513) 845-9872
VariViggen plexiglass canopy

BILL CAMPBELL Box 253 Phelan, Ca 92371
VariViggen brackets and fittings.

MONNETT EXPERIMENTAL AIRCRAFT INC., 955 Grace St Elgin, Ill 60120 (312) 741-2223
VariViggen molded fiberglass parts.

GOUGEON BROTHERS, 706 Martin, Bay City, Mi 48707
VariViggen 105/206 epoxy and 403 fibers for wood construction.

GEORGE EVANS 4102 Twining, Riverside, Ca 92509
VariViggen welded nose and main landing gear. 1-1/4" sq. steel tube.

JESSE WRIGHT (VariViggen builder) 7221 S. Colorado Ct. Littleton, Co 80122 (303) 771-5140
VariViggen prefab wood parts. Send 50 cents for list.

VARIVIGGEN TECHNICAL REPORT - Complete tech report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view, stability and performance flight test data, construction cost, description of car-top wind tunnel, 8" x 10" glossy photo and current issue of newsletter. Price - $10.00 first class mail, $11.50 Air Mail overseas.

VARIVIGGEN OWNERS MANUAL - Complete operational handbook i including normal and emergency procedures, loading, operational record keeping. This manual is a must for those close to first flight. Price - $6.00 first class mail, $7.50 Air mail overseas.

"CANARD PUSHER" SUBSCRIPTION - A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements, building tips, photographs, and flight reports as possible. Details mandatory, desirable, and optional changes to plans and to owners manual. A newsletter subscription and back issues

starting with CP#19 are mandatory for those with VariViggen under construction. Identifies new material sources as they become known. Published quarterly. Price - $6.75 per year first class mail. $8.75 per year air mail overseas. Back issues, $1.50 ea.

VARIVIGGEN PLANS - SECOND EDITION. This is an updated, revised set of very complete drawings and construction manual consisting of a bound 11" x 17" book, containing many photographs, hints and instructions based on actual builders experience over the part several years. It covers the entire airplane, including the engine installation fuel system, and not only covers the original standard wing in both aluminum and foam an fiberglass composite, but it also includes the composite S.P. wing, ailerons, and rudders. The manual identifies sources for all required materials and all available prefabricated parts and components. Price - $165.00 first class mail, $177.00 Airmail overseas.

VARIVIGGEN R/C MODEL PLANS - Complete construction plans for the 18% - size radio controlled model airplane built and flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment and engine in the .35 to .65 cu inch size. 555-sq wing area. All balsa or foam/balsa construction. A maneuverable flying model with outstanding roll rate. Also shown are modifications required for a control-line model (70-ft lines, .19 to .45-cu inch engines) Price - $475 first class mail, $5.50 air mail overseas.

CP23, Page 13

Four-place VariEze! Ken Swain and family on arrival at Hospitality Club's Columbia Flyin. The twins ride papoose-style in special pouches. Ken says they now have grown too heavy. **PHOTO OMITTED**

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THE CANARD PUSHER NO 24 APR 80

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Back Issues	$1.50

Note! Price increase for the Canard Pusher Newsletter. This is due to the higher costs of the paper, printing and builder support. This is our first increase since CP #1 in 1974.

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 24. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 24. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 24. If you are building a VariEze from 2nd Edition plans you must have newsletter 16 through 24. If you are building a Long-EZ from 1st Edition plans you must have newsletter #24.

A Current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave CA., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 Saturday. Closed Sunday.
If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed your reply.

SATURDAY DEMOS RESUMED
In 1975 and 1976 our offices were located remote from our prototype aircraft making it difficult to show them to visitors on an individual basis. Therefore, at that time we had a formal display of the airplanes, including a flight demo each Saturday at noon. After we had our new building on the flight line in 1977, our airplanes were available for public inspection daily, and due to our being gone on occasional weekends, we discontinued the Saturday demos.

Lately, during the last few months, we have had a large number of Saturday visitors, and we have been rolling all the airplanes out for flight demos, including our airshow practice with formation flying etc. These have been well received and thus, we now plan to resume our policy of a scheduled flight demo and composite construction discussion period every Saturday that is not reserved for an out-of-town EAA flyin. We will start the presentation/discussion at 10 am each Saturday with flight demos of our experimental aircraft at approximately noon (weather permitting). This will be done each Saturday except when we will be gone to the following airshows:

26 April 80	Chino, CA	Flyin
24 May 80	Watsonville, CA	Flyin
31 May 80	Lake Isabella, CA	Hospitality Club
2 Aug 80	Oshkosh, Wisc.	EAA Convention
9 Aug 80	Oshkosh, Wisc.	EAA Convention

Bring any of your parts for inspection. We are located near the west end of the flight line at the Mojave Airport about 2 hours drive north of Los Angeles on Highway 14. When arriving at Mojave by car turn east at the Carls Jr restaurant to find the airport.

LONG-EZ AT SUN-'n-FUN, by Dick Rutan
I just returned from a very successful two week trip to the 1980 Sun-n'-Fun flyin at Lakeland, Florida, with the Long-EZ. We originally planned to go non-stop from Mojave to Lakeland at a economy cruise speed. However, before departure we modified the wing strake fuel tank into a baggage compartment, reducing the volume of fuel. With only 50 gallons, non-stop it is possible only with a moderate tailwind. Note that with the strake baggage compartment the prototype has about the same fuel volume as the plan-built Long-EZ. With Pilot, 50 gallon fuel and about 100 lbs of baggage the aircraft was operating near its design gross weight of 1325 lbs. Since I could not fly non-stop I wanted to fly at high cruise speed and fly near the maximum range. The first leg was a "short" 756 sm from Mojave to El Paso, Texas. The second leg was 1506 sm from El Paso, Texas non-stop to Lakeland, Florida. That leg took 8.12 hours at an average 185.5 mph ground speed (tailwind averaged 5 mph). I had fuel remaining at Lakeland to go an additional 170 miles. The fuel flow averaged 5.5 gph at 180 mph true. Some of the cruise data collected are listed:

Alt.	Full Throttle	MP	TAS	GPH	MI/GAL	RPM
9500	Yes	19.2"	182	5.65	32.2	2780
11,500	No	18.0"	175	4.80	36.4	2756
13,500	Yes	18.1"	176	4.75	37.05	2740

On my arrival in the Lakeland area I found myself surrounded by VariEzes escorting me in. We did a formation fly-by and landed. The participation by the "gallactic wonders" at Lakeland was excellent - 16 total, by far the most popular homebuilt in attendance. There were 15 VariEzes and one Long-EZ. Some of the VariEze activities included a designers' award for the best EZ, a VariEze race, a daily bull session and an awards banquet. The award for the best EZ went to Steve Darlington from Anderson, Indiana, immaculate N36SD. Congratulations Steve on a job well done.

The race was flown on Friday just before a mild weather front went through. Bringing 3 hours of the only rain we had all week. We wanted to fly the race out of Lakeland and back to finish in front of the crowd but the air traffic was such that this was not feasible. So we ran the race out of an airfield 15 miles east of Lakeland. We set up a triangular course of 46 total miles. I did not want to get involved in complicated timing or handicapping and wanted the first one across the finish line to be the winner. But 9 VariEzes are tough to start all at once so we staggered the start based on engine size. This put the C-90 out front, the O-200 next and the Lycomings last. The whole gaggle got off in less that 40 seconds and they were all really close at the first turn. Some sight to see all those weird birds so close going around the first pylon. Rounding the last pylon before the finish we had Steve Wood with his boat tail NACA air scoop Continental O-200 Eze in the lead, or so we thought, but much to my surprise Ed Rockwell in his C-90 N7ER was turning the pylon a good mile out in front. Steve Woods was gaining, it looked like a horse race finish right to the wire. The rule was that you must fly down the runway and the first one to cross the intersection at midfield was the winner. Since the approach was about 90 degrees to the runway it meant a turn around the numbers then down the runway. Well, unfortunately Ed made this turn a little wide and Steve, an old race pilot, cut him off and finished just 5 seconds ahead to win. Results follow. Note that even though the Long-EZ has 41% more wing area than a VariEze, it was faster than 4 of the VariEzes. The speeds listed are not corrected for the start interval or losses in the turns. For example, based on actual start times, Steve Wood turned 196.3 mph and the Long-EZ turned 185.7 mph. Two of the EZs were running TAS over 200 mph in the straightaways.

SUN-'N-FUN EZ RACE RESULTS

Placing	Aircraft		Pilot	Speed-not corrected for start handicap.
1	VariEze N56EZ	O-200	Steve Wood	186.8 mph
2	VariEze N7ER	C-90	Ed Rockwell	185.8 mph
3	VariEze N2UM	118 Lyc	Lance Uhley	183.5 mph
4	Long-EZ N79RA	108 Lyc	Dick Rutan	180.8 mph
5	VariEze N57EZ	O-200	Byron McKean	180.6 mph
6	VariEze N36SD	O-200	Steve Darlington	171.9 mph
7	VariEze N70VE	O-200	Herb Sanders	170.8 mph
8	VariEze N2286A	O-200	Mule Ferguson	169.7 mph
9	VariEze N301RW	O-200	Bob Woodall	163.6 mph

The demonstration flown by the Long-EZ at airshow time was intended to show its excellent glide ratio, good maneuverability and wide stall margin. To demonstrate this and to dispel the doubts about canard stability and control we worked up a low altitude, simple aerobatic routine. We want to make it clear that the Long-EZ is not designed for aerobatics and, while we don't recommend it for aerobatics, in the hands of a competent aerobatic pilot the basic positive "g" aerobatics can be easily performed. The 4.5 minute routine flown at Lakeland went like this: Take off at minimum speed, enter a steep bank, full aft stick "corkscrew" climb 720 degree turn to about 500 feet then descent to gain speed and do the same thing starting at 120 knots 4 "g" full

aft stick 70 degree bank topping out at 1200 feet, then split "S" to 200 feet at 150 knots for a loop, a roll, then a split "S" reversal for a Cuban "8". Then, another split "S" reversal to attain 180 knots. At 200 feet, show line center, kill the engine and do a loop, a roll, a 180 degree climbing turn back to show line center. Now at 500 feet and at final approach speed, 65 knots do two 360 degree spiral turns landing show line center all dead stick. Impressive ??? You bet - - - - We received numerous letters, calls, and personal comments at the flyin - - - "I had no idea that that could be done etc. etc. - - -". We have even received a formal request to perform at the 1980 World Aerobatic Championships to show the foreign countries what is available here.

During the return from Lakeland, I stopped off to visit some local EAA chapters at Dallas, Austin and Phoenix. Total flight time 52.2 hours, two weeks on the road, used 279.0 gallons of fuel for an average of 5.34 gallons per hour. Much of the flying was spent giving back seat rides and checking out six new pilots in the front seat.

BURT'S TRIP DOWNUNDER
At the invitation of the Sport Aviation enthusiasts of New Zealand and Australia, Burt traveled to those countries in March/April. Purpose of the trip was to conduct composite structure workshops and to discuss composite inspection with homebuilt inspection agencies. The hospitality was great. Burt stayed with ten different EAA families. In addition to some sight seeing, Burt was able to inspect several VariViggen and VariEze projects under construction and fly two VariEzes. At the Latrobe Valley flyin near Melborne there were 4 VariEzes flown in to join the 54 other homebuilts in the Australia National Flyin. Two of them flew more than 2400 miles from Western Australia. Congratulations Noel Bramish, Geoff Danes, Ian Clubb and Bob Keehner on four beautiful EZs. Thanks also to Tony Stinton, Ian Williams and the other EAA'ers who worked so hard to arrange the trip. Some observations of interest to us American homebuilders:

Even though New Zealand only has 3.5 million population, they had 53 homebuilts at their January flyin!! Their activity is high despite tight government control: All materials purchases must be accompanied by a release note. Workshop must be approved before you can start building. Only specific designs may be built. Any modifications must be approved and documented with drawings and engineering. Stage inspection is intensive - even the book ends must be approved! No material substitute is allowed. Test pilot must be approved.

Both Australia and New Zealand Governments provide a composite aircraft construction school to teach methods and inspection. Some of the class projects include building a VariEze, our confidence samples and bookends.

HOSPITALITY CLUB FLYIN at Bullhead City, AZ, by Mike Melvill
With Burt still on a trip to Australia, Dick in the Long-EZ and myself and my Mother in the VariViggen, took off from Mojave and headed east. Perfect weather with unlimited visibility made for a very pleasant flight. Dick occupies himself with fuel flow checks at various power settings and altitudes. We started out on the deck and ended up at 11,000 feet. One hour and thirty minutes later we made a two ship formation flyby at Bullhead, and counted 11 VariEze's on the ramp.

We all crossed the river on the ferry boat and had an early lunch in the casino restaurant. We lost a couple of dollars very quickly, then crossed back to the airport where we spent the rest of the day chatting with all the EZ pilots, potential pilots and general public. Both Dick and I gave short demonstration flybys, later in the day, and Dick treated everyone to most of his "Sun-'n-Fun" aerobatic show.

As it got dark, there were 16 VariEzes, 1 Long-EZ and 1 VariViggen on the field. We all crossed to the casino where we had an excellent buffet dinner for only $4.00. After dinner, Dick showed some breath-taking slides of the Long-EZ doing aerobatics shot from an aft-looking camera, mounted on the nose.

Don Shupe gave out several awards, and Dick awarded a VariEze belt buckle to Gary Hertzler of Tempe, AZ, for having the most outstanding VariEze. A real jewel, powered by a Continental A80. After dinner we checked out the various gambling spots along the Nevada shore of the Colorado river. It was a lot of fun, but could cost you money if you were not careful!

Early next morning 5 VariEzes were out in a dawn patrol flight, while the rest of us were trying to sleep! After a hearty breakfast at the casino, we spent an enjoyable morning looking inside cowlings, and answering questions, and generally having a good time. I must say the feeling of being with a bunch of VariEze pilots, their wives and girlfriends like that, is great.

I took Bruce Evans for a ride in my Viggen, then Dick did his aerobatic show, and we all started heading for home. A total of 18 EZ's 1 Long-EZ and 1 Viggen actually flew in. EZ's came in from as far away as Redding, CA, and Los Cruces, New Mexico.

We did a couple of close formation flyby's then headed back to Mojave. Time enroute 1:20. We really had a great time and vowed to try to get to any future Hospitality Club flyins. Congratulations to the organizers of a really fun flyin, let's do it again, soon.

LAKE ISABELLA HOSPITALITY FLY-IN
The Hospitality Club is planning their next fly-in for May 31st and June 1st. This will be at California's Lake Isabella in the Kern Valley. There are plenty of camping areas, the lake is within walking distance as well as the river. A really beautiful area for a fly-in. For more details call either of the following - Bruce and Bonnie Tifft (805) 649-2721, Don & Bernadette Shupe (714) 593-1197.

HOSPITALITY CLUB PROPOSED TRIP to the Bahamas.
Plans are still very tentative but at this point we are planning to depart California on December 20th, spend one week in transit, and plan to be in the Bahamas from 27th on. We are planning to take 3 weeks. However there are many of you out there with only 2 weeks, and of course you could get over there easily in a couple of days, depending on weather. If anyone would like more information on this trip contact: Bruce and Bonnie Tifft,
8746 Ventura Ave,
Ventura, CA 93001
(805) 649-2721 (evenings)

We hope to have firm plans and dates within the next few weeks so we can proceed with reservations and deposits.

SAFETY MODIFICATIONS by Dick.
During my travels I am dismayed at the number of VariEzes flying that have not accomplished the safety modifications. Check CP #21, pg 4-5, CP #22 pg 8, CP #23 pg 7. Things like rudder travel, Continental O-200 starter bearing plug, 1/4" rod ends, canopy safety latch, EON-8000 seat belt buckle, etc, etc, are extremely important and should be accomplished immediately. Do not procrastinate with safety.

LONG-EZ UPDATE
(See also Long-EZ flyer, "Which one?" and "Sun-'n-Fun" in this issue, and CP #23).
Long-EZ plans are now available!!
The major benefits of the Long-EZ over the VariEze are listed below:

(1) Lower (65 kts) landing approach speed, can touch down at 50 kts with full aft stick.
(2) Better visibility for takeoff, approach and landing.
(3) Higher roll rate, lighter and more responsive ailerons.
(4) Stiffer elevator forces, more solid feel in pitch.
(5) Increased useful load, cabin size and instrument panel space.
(6) More baggage area. Cabin-accessible area in wing strakes.
(7) 60% more range and less runway required.
(8) Better high-altitude performance.
(9) Better maneuverability, yet more docile for low proficiency pilots.
(10) Greater stall margin.
(11) Ability to use 100 to 118 hp engines without nose ballast.
(12) Ability to use lighting, alternator and starter.
(13) Ability to use 500 x 5 tires.
(14) Improved structural materials.
(15) Improved structural methods and easier jigging.
(16) Overlap, incidence - adjustable wing attach (no wing fittings).
(17) Improved trim, electrical, and fuel systems.

The major benefits of the VariEze over the Long-EZ are listed below:

(1) Lower cost - materials are approximately $500 less due to smaller size and cheaper type foam.
(2) Ability to use the A75, A80 and C85 engines.
(3) Easier to trailer (Long-EZ must be tilted to meet the 8 ft width requirement).
(4) Faster to build (Long-EZ requires about 15% more work).

Note that there is only a minor difference in speed. Our Long-EZ outran half the VariEzes in the Sun-'n-Fun race.

The adjacent photos show Johnny Murphy of Cape Canaveral with his Long-EZ. This is the #2 ship, started last year. Johnny's project was built from the plans before they went to the printer, thus he provided assistance in debugging the plans. The Long-EZ plans are layed-out and

detailed very clearly and completely. They are drawn based on our experience providing support for over 2000 VariEze builders. Thus, we expect far fewer changes and building problems than with the VariEze.

The Long-EZ design has taken advantage of the numerous improvements noted based on over 250 EZ first flights. Testing has been more extensive. When the VariEze plans first went to print in 1976 the prototype had 100 hours flying in 4 months and had been flown by about 6 pilots. Long-EZ prototype has over 250 hours flying in 10 months and has been flown by 25 pilots (front seat).

Our original plan of a addendum rather than a new set of plans was foolish, since even the unchanged canard and elevators were redrawn to improve their clarity and to eliminate common builder errors. The Long-EZ plans Section I include finishing instructions and complete electrical system drawings. Section IV is required and IIA or IIC are needed for engine installation. The Long-EZ Section I includes all updates for these Sections. Thus, Long-EZ builders do not need newsletters previous to CP #24.

The fact that the Long-EZ plans are completely new rather than an addendum eliminates the confusion of plans editing. However, some of you have purchased VariEze plans with the intent to build a Long-EZ when the addendum was published. Thus, we are providing a plans trade-in program so those people can get credit toward the Long-EZ plans. If you bought a VariEze Section I from RAF after July 15, 1979 with the intent to build a Long-EZ, contact RAF for terms for trading them for the Long-EZ plans.

We are just now finishing the Long-EZ Owners Manual. It should be printed and available by the end of May.

LBF RACE - OSHKOSH 1980 - We are still active in planning a VariEze/Long-EZ class race in the LBF race this year at Oshkosh. Since a VariEze is not competitive with the best formula racers for the major purse, we have established a class within the race for the fastest VariEze in each of the three categories. We have been successful in getting $1200 so far for prize money and this could double by race time. The race is a timed speed/efficiency contest. You get 18 gallons to go 500 sm and the fastest using no more than 18 gallons wins. You get credit (speed adjustment) for fuel not used under 18 gallons. Use more than 18 gallons and you're disqualified. I just learned from the LBF organizer Nick Jones that he is now giving prize money to more than just the 1st place winner - $500 for 2nd, $250 for 3rd, $150 for 4th and $100 for 5th. We may have some EZs in this money or maybe the $7000 overall purse!! You never can tell what will happen in a race so start planning now.

For rules, see the December 1978 Sport Aviation, C.P. #22 or an upcoming Sport Aviation. You can write to the race director -

Aaron King
1893 Greystone Road,
Atlanta, GA 30318

for an application, race number and official rules. There is a $10 registration fee and you can request your race number at that time. (list 3 choices for race number). Get your applications in now before

the good numbers are taken. You must be registered prior to the July cut off to race. See you on Race Day.

TWO PHOTOS OF JOHNNY MURPHY'S LONG-EZ UNDER CONSTRUCTION OMITTED

FLASH - At the down-under fuel efficiency race held 6 April 1980 in Australia (same rules as LBF), Geoff Danes VariEze easily won over 4 other types. Placing and fuel-corrected speeds are listed below.

1st	VariEze	174.5 mph
2nd	Mustang II	160.2 mph
3rd	Cassett	160.0 mph
4th	Tailwind	154.2 mph
5th	T-18	Disq - used too much fuel

LONG-EZ/VARIEZE MIX
We have had many requests concerning the possibility of converting partially completed and even complete VariEzes into Long-EZs. This may work, and may fly ok. However, since we have not done it ourselves, and have not flight tested it, we can not recommend it, and neither can we provide builder support for those who elect to do it. Anyone who elects to try to do this is entirely on his or her own, and it will be your responsibility to handle all modifications, to foresee any interference problems and to fit parts that may not go together. We would also request that you do not call your airplane a VariEze or Long-EZ. Please call it something else like "Smith Special" etc. Remember, you will be doing exploratory flight tests where all characteristics are in question until you have flown and tested them. We are supporting over 2,000 builders now, and there would not be enough hours in the day for us to be able to work out problems with individual builders of a "hybrid". Please don't ask us, because we will have to say no.

WEIGHT CONTROL - Too many builders are loading their airplanes down with extra equipment and heavy finish jobs. They are going to miss the real thrill of flying their EZ at a light weight, and they will find their useful load disappearing. Here is the trap -- if you address each item as, "Oh, that's only one/half pound, it's a small percent of the empty weight", you will find that the sum of all the extras will add up, and when you weigh your ready-to-fly airplane you will be scratching your head and saying, "where is it all?". Believe me, it happens every time.

We have a strong recommendation for all of you, and that is to delay installation of any equipment not absolutely required for flight, until after you have flown your airplane a few hours. Then, you will have a much better chance of a successful flight test program -- the airplane is easier to fly light and uses less runway. Also, if you make a real bad landing during your transit it will put a lot less stress on your landing gear. Then if you must, load on the equipment, at least you will get to see first-hand the effect it has on performance and runway requirements.

This philosophy also goes for modifications, too. Don't try something new on your unflown new airplane. Build to the plans first, where you know from our experience that it will work. Fly it that way, then try your modifications.

EON E-8000 SEAT BELT UPDATE
In CP #22 we reported the EON E-8000 seat belt was unairworthy and that Dr. Cross, President of EON Corp would. replace the belts with one that was acceptable. Unfortunately Dr. Cross reneged on his commitment. Long delays were reported and the ones he did replace were still the same type (dash 4) and in our opinion still unsatisfactory. We recommended the EON E-8000 be removed from your aircraft and replaced with another approved style. We have been very active with the FAA to the the cap-over buckle recalled. Now, over 5 months since we recalled the buckle and pointed it out to the FAA and EON, Airworthiness Directive dated 4 March 1980 80-05-04 amendment 39-3706 has also recalled them.

PROPS FOR VARIEZE AND LONG-EZ
We have approved and recommended the following prop manufacturers.

Larry Weishaar
1924 No. 6th
Springfield, IL 62702
(217)544-6086
(Homebuilt prop)

Ted's Custom Props
Ted Hendrickson
9917 Airport Way
Snohomish, WA 98290
(206)568-6792

B & T Props,
5746 Ventura Ave.
Ventura, CA 93001
(805)649-2721

Bill Cassidy
4652 Montview Blvd,
Denver, CO 80207
(303)322-3423

Ray Hegy
Marfa, TX 79843
(915)729-4249

Most of our testing has been done using Ted's props, and therefore we tend to compare everyone else's to Ted's. Ted reports that he has finally caught up his VariEze prop production to where he can offer much better delivery than he has been able to over the past year or so. He also reports that, lately he has been supplying steeper pitch props to O-235 Lycoming powered VariEzes in the form of a 58 x 74 and in some cases 58 x 76 prop. A couple of builders using these props have reported good results. We are presently using a Ted's 58 x 72 on the Long-EZ.

Any potential prop makers who would like us to recommend their props on either the VariEze or the Long-EZ or both, should send us a representative prop, which we will test on our prototypes, and if it comes up to our standards, we will keep the prop for further testing and approve and recommend it in the Canard Pusher. If it does not meet our standards it will returned freight collect.

PREFAB WING FOR VARIEZE
In CP #20 we promised an update as to whether RAF would approve and recommend them. The testing we did manage to do last summer and fall proved unsatisfactory. The amount of work necessary to finish them

through paint is not significantly less than a good plans-built wing, and the weight savings is negligible if any. Also, we experienced structural cracks requiring repair. The attach system was inadequate, resulting in our having to destroy structure to remove the wings. It is possible that these problems could be solved but we have no current plans for further testing, thus, we cannot recommend their use.

ROTORWAY RW-100 UPDATE
You may have noticed that Rotorway has, once again, started their advertising blitz alluding that the RW-100 is now approved for the new Long-EZ. We understand there have been some changes in the engine and some further testing. However, we have not seen, nor do we have any first hand information on the engine as it is now. The advertising mentioning the Long-EZ/VariEze was done without our knowledge or consent and until we have had the opportunity to evaluate/test the engine first-hand we cannot recommend its use in any of our aircraft. We encourage new engine development and wish Rotorway success in their efforts. When the RW-100 is approved for Long-EZ/VariEze use it will be reported in this newsletter.

In our attempt to gather information on the acceptability of the Rotorway engines, we have been trying to access the reliability and maintainability of the helicopter version of the engine. If you know of a Scorpion owner willing to discuss his engine service record, please let us know his address so we can contact him. All information will be in confidence, we merely want to compile data on the engine's reliability.

BUILDER HINTS

Brake Cooling-
The "Real" George Scott reports brake overheating with his tight-fitting wheel pants. He has solved this by installing cooling ducts in his wheel pants to cool the brakes. He has detected no change in cruise airspeed, and has not experienced any brake fade since installing per sketch below. **SKETCH OMITTED**

Hotwire Templates-
An excellent way to make hot wire templates, is to glue the paper template to a clean piece of 1/16" thick aircraft plywood, available from Spruce or Wicks or hobby stores, using RAE or Safe-T-Poxy. Squeegee the paper onto the plywood and allow to cure overnight. Band saw or saber saw as close to the line as you can, finish to the line with a smooth metal file and/or sanding block. Lubricate the edge with pencil lead. This makes a really fine template with zero shrink. Do not use water base glue, it will shrink the paper.

Elevator Positioning
VariEze Section I, page 5-5 (or Long-EZ page 11-5) shows a smooth transition from the trailing edge of the canard onto the top of the elevator. This is not easy to attain, and still get full and easy elevator travel. It is acceptable to have up to 0.1" of "step-down" as shown below. However, be sure the slot shape and elevator shape are precise. **SKETCH OMITTED**

Yaw String

We have always flown our VariEze with a yaw string glued to the front edge of the canopy. This is used in sailplanes and is an excellent heads up yaw reference. Glue or tape a 3" long piece of yarn or string to your canopy leading edge, and be sure it is on the aircraft centerline. Mark the canopy where the string should lie in coordinated flight. **SKETCH OMITTED**

VariEzes can use the lighter Long-EZ canopy layup.
Save weight with an approved new layup schedule on your canopy. On the original VariEze the canopy layup is actually stronger and heavier than it really needs to be. New layup schedule is as follows for both the inside and outside layups: Front and back areas - 3 plies BID at 45 degrees. Side rails 2 plies BID at 45 degrees plus 2 UND lengthwise.

Prefab brackets available for VariEze.
The VariEze rudder belcrank brackets, Section I page 16-1 and 16-2 and A-4, have been slightly redesigned for Long-EZ and are available from Ken Brock and are applicable to a standard VariEze. Order 4 each part #CS71. Brock also has the rudder pulley brackets, Section I, page 16-1, order 2 each #CS72.

Long-EZ fuselage door
can be installed on VariEze, if you wish. See the detail reprinted from the Long-EZ plans.

The door shown provides a hole to reach through allowing you to fully lock the C-1 handle when you are outside your aircraft. The door also allows emergency canopy opening from the outside. Print the letters "EMERGENCY CANOPY OPENING" on the outside of the door. Apply the label shown on the inside of the door.

If you desire to install a key lock to secure your aircraft from radio theft, install a small drawer-type key lock (available from hardware stores). **SKETCHES OMITTED**

STROMBERG CARBURETOR
Last CP we reported a problem with a Stromberg carb in a VariEze. We have no experience with the Stromberg and had asked if any out there had used it successfully. We found 4 using the Stromberg carb ok but they reported that the float level is critical. Also the float valve opening is different for pressure and gravity systems. Be sure yours had the gravity valve. If you are anticipating using a Stromberg, we suggest you contact those using them in VariEzes.

Steve Stuff, 517 Roberts Street, Monroe, WA 98272	Gary Hertzler 2507 E. Balboa Tempe, AZ 85282
Fred Keller SRA Box 2385 Q Anchorage, AK 99507	Bruce Tuttle 4471 S. 1625 W. Roy, UT 84067

Float needle valve seat part # 384585 has a .113 dia. seat to accommodate 2-4 psi pressure at the carb. Part # 383911 has a .187

dia. seat for the half psi or gravity pressure at carb. (VariEze float level 13/32. For a C85-12 engine carb should be a NA-S3A1 Stromberg part # 380167, venturi 1-3/8, main discharge jet #22, main air bleed #66, main meter jet #45. But be sure the float needle valve seat is for the gravity system.

SOLUTION TO STIFF FUEL VALVES
One homebuilder reported his stiff fuel valve problems were solved by using a fuel valve lubricant called "parker fuel lube" available in most aircraft supply stores. Cost $10 or $12 for a small can. The lubricant is not soluble in fuel. This small can could lube dozens of EZs.

FUEL GAUGE VISIBILITY
Micro or traces of air entrapped in the fiberglass layup at the visual fuel gauge area will result in poor gauge readability. This is a very common problem, existing in a least half the airplanes we have seen lately. The gauge will read with excellent contrast only if the layups are perfectly clear. If you have not yet installed the fuel tank top, inspect your gauge area carefully. Without touching the surface you should be able to see your fingers clearly enough to count them when looking through the gauge. If it is not perfectly clear and translucent, cut out the gauge area, about 0.7" wide. Sand adjacent skin inside fuselage and out. Then layup two plies BID at 45 degrees onto two pieces of "Saran Wrap" (or glad-wrap) thin plastic kitchen plastic. Apply to inside and outside using your fingers on inside and outside to expel all air. The plastic wrap keeps the layup from drawing in air. After cure, remove the plastic. The result will be a gauge clear enough to see your hand through and will give a good contrast with fuel.

VARIEZE RUDDER TRIM.
The rudder trim as called out in the VariEze plans, is to enable you to correct any tolerance buildup that may cause your VariEze to yaw one way or the other. This system is intended to allow the pilot to set the neutral position of the left rudder at the position required for "ball-centered" flight. Most EZs trim with the rudder deflected left about 1/4" to 1/2". The rudder position for "ball centered" flight does not change with airspeed. However, due to airloads and stretch in the system from rudder to yaw trim system, the rudder blows toward the right at high speeds and slacks out to the left at low speeds. Thus, because of our trim system, trimming is needed when airspeed is changed. If we block the rudder itself, hard at the correct neutral position, we do not need inflight trim adjustment and we can seal the gap in the left rudder. Thus, inflight adjustment of trim when speed is changed is not necessary.

Proceed as follows: Visually note the position of the left rudder at cruise flight with the ball centered. Land, then block the neutral position there, with a balsa block epoxied to the winglet, closing the gap full span. Then fly with the yaw trim knob full in (inactive) to confirm position of the block. From now on use the knob only for parking brake function, not yaw trim. Or, completely remove the system if parking brake is not desired. Some EZ flyers use a small wheel chock instead of the parking brake, A nylon parachute riser attached to the chock allows you to haul it aboard when ready to taxi.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LCP #1, MAN-GRD, pg 21-8
The Bendix fuel pump called out does not have a means of safetying the bottom cap. This is done on certified aircraft as follows:
Bend the small tab shown 90 degrees, drill a #50 hole in it, safety with .032 stainless safety wire, tied to the fitting. **SKETCH OMITTED**

LCP #2, MEO, pg 19-10
Oops! We forgot to include the tie downs in the Long-EZ plans. Drill a 3/8" hole through the wings, 13" inboard along the leading edge, and 9.5" aft of the leading edge. This will assure that you do not drill through the shear web, but will be just aft of the shear web. Now flox a piece of aluminum tube into each wing, so that the tube is flush with the skins top and bottom. 3/8 O.D. x .049w 2024T3. Obtain two AN4 bolts and make up a couple of removable tie downs as shown These can be stored in the centersection spar when not in use. **SKETCH OMITTED**

LCP #3, MEO, Sect VI

See landing brake bushing revision below under VariEze plans change.

LCP #4, DES, Chap 7 & 21
See Safe-T-Poxy recommendation below for fuel areas.

VARIEZE PLANS CHANGES

MEO, Sect I, pg 18-3 & 19-11
Change "Nyloseal .050 wall" to "Nylaflow with .025 wall".

MEO, Sect VI
Landing Brake. Brock part #LB10 has been supplied with #10 hole. It should be drilled out with a 17/64 drill and a CS13 bushing should be inserted and clamped with the AN3-7A bolt as shown. **SKETCH OMITTED**

DES, Sect I, Chap 12 & 21
New construction only. The interior fuel tank layup and fuselage side layup should be done using only Safe-T-Poxy. Laboratory tests have shown Safe-T-Poxy to be more resistant to fuel than either Lambert or RAE epoxy systems. Our survey of possible fuel contamination (see CP #22 pg 7) did not reveal anything of major concern, although several of the 64 responding, reported a gummy substance on the float valve seat. Be sure to follow the CP #22 pg 8 Owners Manual carburetor inspection requirement.

MEO, Sect III
Radio Shack buzzer for warning is part #273-051

MEO, Sect IV
Under taxi testing add "Remove wheel pants for taxi tests to avoid overheating brakes".

VariEze Owners Manual, 2nd Edition pg 24, 3rd Edition pg 23
Add the following to pilot checkout criteria:
"5. Weight and balance must in the first flight box (pg 26/27).
6. Briefing must emphasize that the aircraft should never be rotated past the angle that places the canard on the horizon for takeoff or landing.
7. Pilot being checked out must have minimum of 10 hours each in at least two type aircraft in the last 4 months (5 in the last 30 days) & feel competent and comfortable in them during marginal conditions such as crosswind landings near demonstrated limits, etc".

VariEze Owners Manual, 2nd Edition pg 34, 3rd Edition pg 33
Add the following to aircraft first flight procedures:
"It is strongly recommended, if at all possible, that the test pilot have at least 10 hours VariEze experience or, at minimum, 10 hours in a small aircraft with a fast approach speed like a formula-one racer or other relatively 'hot' homebuilt".

FOCAL POINT - FIRST FLIGHT ASSISTANCE
The following VariEze builder/pilots have volunteered to give first flight assistance to any VariEze builder in their respective local areas. Many others have also done several first-flights on EZ's in their areas.

Steve Stuff Ray Cullen,

517 Roberts Street Monroe, WA 98272	1116 6th Street Tillamook, OR 97141
John Steicher, 960 86th Street, Downers Grove, IL (312)985-6671	Bob Woodall 8302 26th Ave, Adelphi, MD 20783 (301)422-6027

Thanks very much for offering your help, this is a much needed service and anyone else wanting to offer this kind of help should let us know, and we can publish names and addresses. With well over 200 VariEzes flying now, there is really no valid reason why a builder with no VariEze experience should have to make his first flight. We strongly recommend that any first flight of any new airplane be made by a pilot with at least 10 hours in type. Do take advantage of this from the many pilots who offer their skills and experience. A back-seat ride is not adequate checkout. Get the 10 hour front seat time or locate someone who has this experience.

"EZCALC" Electronic Instrumentation

The Long-EZ has such an impressive long range cruise capability that to fully utilize this unique efficiency we are developing an electronic unit that will give instantaneous fuel flow (gph) and average for the trip. This will also save panel space by displaying other engine data. Also displayed are: total fuel used/fuel remaining, fuel/distance/time remaining (pilot inputs ground speed), battery voltage, OAT, CHT, RPM, EGT, fuel low warning, clock local/Zulu, and approach timer. We installed a prototype in the Long-EZ for the trip to Sun-'n-Fun. We found it to be a invaluable aid in long range cruise control. For any given air speed and altitude we found we could lean for optimum and found my normal leaning technique was wasting fuel. An example, using my old technique at 180 mph true, I was using 6.2 gph, but using the "EZcalc" I could refine the mixture back to 5.56 gph for the same speed. Therefore we could easily exceed the advertised range for the aircraft. We learned a lot about leaning on the record flight using the Sears fuel counter and stop watch. But this unit gives a direct read out on fuel flow and you see it change as you move the mixture control. It's interesting to see the difference, with full rich at cruise power its 7+ gph and to be able to cut it back to 5.56 gph for the same speed is quite gratifying.

The "EZcalc" micro processor chip is now being designed and programmed for our special needs. There is a 15 week lead time on these new chips. We can expect availability of this unit by late summer.

ACCIDENTS

Since CP #23 there have been two off-field forced landings in VariEzes due to engine failure. No injuries, but both aircraft received major damage. The one in Southern California landed in the desert after the engine failed (reason yet unknown) taking the gears off and buckling the forward fuselage. The other in central California - engine failed just after take off when the pilot selected a tank with water in the fuel. (non-standard fuel system). The field was undulating soft grass. When the aircraft touched down it took the main gear off and

damaged the under fuselage and wings. The nose gear was not extended. Rain water got into the tank due to a very badly deteriorated "O" ring in the fuel cap. The aircraft had no gascolator or tank drains.

What is learned from the above? First, we don't recommend the nose be retracted for any landing no matter what the terrain is, even water. The nose gear provides extra cushion and keeps the nose from slapping down and digging in after the mains hit. The one possible exception could be brake failure after landing to retract the nose to keep from running off into unfavorable terrain or obstacles.

Water in the fuel system - - be sure the cap "O" rings are in good shape. Be sure all three drains are installed and used. If you suspect water, drain at least two quarts. Drain first while the nose is down from the wing tanks then from the gascolator with nose up. Some times it takes a lot of doing to get to the water. Run your engine at high power for awhile before take-off (nose up) to purge the water. Better to have it quit on the ground than just after take-off.

Don't be in a big rush to switch tanks. Have a safe landing area in sight before switching tanks if you can. Especially the first time you take fuel from the tank. In the case of water, even if you switch back to the "good" tank, you may not get it going in time. It takes a long time to purge water out of the carb. Also don't take short cuts on your systems, it takes a lot less time to do it right the first time than rebuild it.

Reference the Australian fatal VariEze accident reported in CP #23 page 7. We have learned that the pilot's total flight experience in the last 2 years had consisted of 1 hour solo and about 3 to 4 hours dual. He grossly over-controlled the aircraft in pitch on his first take off, flying at a relatively heavy weight at a relatively aft cg. Based on this and analysis of a previous accident with similar statistics, we are recommending additional limitations for the VariEze operators manual. These are listed in the VariEze plans changes section of this newsletter (page 6).

SHOPPING
NOTE! RAF cannot advertise complete or partially complete VariEze's, due to the inference that we have approved the quality. Our policy is that we will advertise your engines and propellers only.

TIRES: Both Aircraft Spruce and Wicks now stock Goodyear 6 ply ribbed tires. This has been the most satisfactory tire we have tested so far. We recommend them for both VariEze and Long-EZ. These tires should be inflated to 80 psi. Long-EZ now has over 240 HR on a set of these - they may go 300+ HR. Toe-in is 1/4 degrees.

HOUR METER: Both Aircraft Spruce and Wicks stock a VDO hour meter slightly different than the VDO 331-011 we recommended in CP #22. It is the same size and has the part # 1763-002-016.

Construction drawings for a VariEze trailer. We mentioned these in the Canard Pusher previously, and have received notice of a change of address. For more information contact:
C.A. Gross
6761 Crestview Dr.

Yucca Valley, CA 92284

Lloyd G. Eash, 541 Utah, NE, Albuquerque, NM 87108 has a disassembled Continental A-75 plus all kinds of parts for these engines. However, he does not want to piece-meal it, and would prefer to sell the whole lot to a VariEze builder. Contact Lloyd for prices.

For Sale - Brand new Ted's prop. 58" x 70" for C-90. $185.00. Alan McPherson (402)258-4212.

RAF NOW SELLS AND STOCKS EZ CANOPIES
RAF now has in stock at Mojave both new and slightly blemished canopies. These canopies are for both Long-EZ and VariEze. If you order one to be shipped to you it will be shipped FOB Dayton, Ohio. Or, save all shipping costs and pick one up at Mojave.

Prices are as follows:	Clear	$199.00
	Green	$229.00
	Smoke	$239.00
	Bronze	$239.00

Blemished - Price varies with extent of defect.

Note: Canopies are 94" x 25" x 13". If your car is not big enough, a canopy can be mounted to the top of the car with duct tape.

LANDING GEAR - RAF has both nose gears and main gears in stock for immediate shipment, or save yourself shipping costs and pick them up here at Mojave.

Prices are as follows:	Nose Gear	$49.75
	Main Gear	$277.95

These prices are FOB Mojave and these will be shipped freight collect. Generally we ship by Greyhound Bus, since the main gear is too large to go UPS. Shipping varies from approx. $10.00 to $26.00 on the east coast. Those of you ordering from foreign countries, please add $20.00 for shipping and handling. They will be shipped Air Freight collect from Los Angeles.

3-SHIP POSTER - The 18" x 23" poster we have for sale for $2.75 each or 2 for $5.00 plus $1.00 for postage is in color and is as shown on the cover of CP #22, consisting of Burt flying N78RA - the Defiant, Dick flying N4EZ - VariEze and Mike flying N27MS - VariViggen. This is a really excellent poster, printed from a beautiful photograph taken by Budd Davisson, and may be obtained autographed by the three pilots, or plain.

SANTA PAULA AVIONICS. Santa Paula Airport, Santa Paula, CA 93060 can take an Escort 110 and change it to an intercom and adjust it to draw only 0.6 amps very reasonably. Bruce Tifft recommends it, he has not had to charge his battery since.

OVERSEAS FOCAL POINTS
The purpose of this section is to list anyone willing to help other builders in their areas overseas.

Builders in France, contact -
Jaques Lesschaeve.
218 rue de la Rianderie,
59700 Marcq en Bardoeul
FRANCE

Builders in Switzerland, contact -
Rudi Kurth.
Langgasse 51,
CH-3292 Busswil
Switzerland

For any builder wishing to share shipping cost to Germany as mentioned in CP #23 contact -
Lt. Peter Maguson.
Post Fach 499
6541 Hatin Flug Platz,
West Germany.

When shipping the Main Gear to overseas customers, we have found that they ship better and take up far less space if wrapped individually rather than being boxed in quantity. To box the gear takes a great deal of time on our part and we do not have the facility to do so.

VARIVIGGEN NEWS
N27MS has been flown on several cross countries since the last newsletter, and has been trouble free. Ground speeds consistently are 160-165 mph with fuel flows of 7.5 to 7.9 gph. Sally and I have been very satisfied with our Viggen so far and would not trade it for any airplane flying.

Arthur Schwartz will be coming to Mojave in May to get checked out in the Viggen prior to flying his own. Once again, I encourage those of you Viggen builders who are ready to fly or close to it, to take advantage of our offer of a check ride before flying our own. I did it with Burt's Viggen and heartily recommend it. The difference of knowing what to expect and not having any idea, can really make the difference between having a totally uneventful and satisfactory first flight, and possibly damaging not only your airplane but your pride.

Lou Cislo in Hawaii reports good progress on his Viggen, although being so far from the "big island" means much delay in obtaining needed materials. B.W. Rottschaefer of Wyominssing, PA, reports that he lacks only installation of his cowling and paint and hopes to fly this summer. Frank Saunders from Miami, FL reports having repaired his beautiful Viggen after a gear up landing and should be flying again soon. Both Jack Rosen and Frank Stites report excellent progress and expect to fly this summer.

So much has been said in previous newsletters about the handling characteristics of the VariViggen, particularly the pitch trim change, with power changes, that I hesitate to go over it yet again, but since it apparently has been a problem for several Viggen pilots, we are more aware of it than most people. During some of my demo flights in the

Viggen I have taken off at minimum flying speed, then immediately forced it into a full-aft-stick climbing turn. From the pilot's seat this maneuver is not difficult, neither does it seem dangerous, however several observers from the ground have expressed concern over what would happen should the engine fail abruptly. Dick Rutan and I decided to find out.

I flew level at 5000 ft. at 60-70 knots, then went to full power to simulate a take-off, 500- ft. being the simulated field altitude. I 'rotated' as soon as possible and immediately began a steep climbing turn. Dick abruptly pulled the power to idle with no prior warning. We were 70-100 ft above our 5000 feet "runway", I countered the pitch up, rolled wings level, pushed over to pick up some airspeed, then flared to land at 5000 feet. Frankly I was surprised that this was easily accomplished. I had absolutely no difficulty in arriving at 5000 feet (ground level), wings level and with an acceptable sink rate. Of course in an actual situation such as we simulated, you would not be able to fly back to the runway, nor would you have time to lower the gear, so you would tear the airplane up, however it is a very survivable situation. Dick tried a few of the same maneuvers with approximately the same result.

My opinion is that a proficient VariViggen pilot will have no problem at all in handling a situation like this, which is, lets face it, the worst case you could encounter. However a low time, or low proficiency pilot flying a Viggen for the first time, probably would not be quick enough to counter the pitch up with less than acceptable results. One thing the test did prove, conclusively to me at least, was that the Viggen has more than enough nose down elevator authority. At no time during the tests did Dick or I ever require full forward stick.

Hopefully this will be the last word on the pitch trim change with power change. It is important to know about it. It is very easy to get used to, in fact after an hour or two in a Viggen I don't believe you would even be conscious of making adjustment to counter it. I certainly do it without conscious thought, and have never considered it to be a problem. Rather it is unusual, and therefore could catch an unprepared pilot. The main thing for the beginning Viggen pilot to remember is that if the engine fails or if power is abruptly retarded he must move the stick noticeably forward to maintain the same flight path.

FOR SALE - Lycoming O-360-A3A, 3 hours SMOH. Stainless exhausts, King radios, various instruments, and Viggen equipment. Send S.A.S.A. for list and prices to

John Poehner
409 Hillwood Court
Flushing, MI 48433

VARIVIGGEN PLANS CHANGE

The forward aileron cable attached to AB4, as shown in both first and second editions of the VariViggen plans interferes with the main gear when it is in the up and locked position. The best solution to this problem is to install the main gear before installing AB2's, AB3's and AB4's. Then install the belcrank assembly at an angle, such that the aft aileron cable attach point on AB4 remains at W.L. 4.6, but the

forward point is raised up 0.9. Check this on installation to clear your main gear when it is up and locked. The turn buckle called out to mount directly into the forward end AB4 assembly, should be moved inboard into the next bay (between WR25 and WR35.54), to ensure no interference between the turn buckle and the top of the main gear.

Bill Campbell is working on his outboard wings and reports the following mistakes in the second Edition of the Plans.

Chapter 8, page 29, part # WA1, B.L. 46.8 should be 47.3 and dimension 1.9 should be 2.4.

Composite Standard Wing chapter, Page A23, full size template at B.L. 114 (wing tip). F.S. of leading edge of template should be at 173.1 and therefore all fuselage stations from F.S 175 through F.S. 185 must be changed by one inch. Thus, F.S. 175 becomes F.S. 174, F.S. 176 becomes F.S. 175 etc. to F.S. 185 which should be F.S. 184. F.S. 188 through F.S. 199.75 are correct.

Thanks for pointing these two problems out to us Bill.

Viggen Builders add to your Owners Manual - Demonstrated crosswind component = 25 knots.

Several Viggen builders have wanted information to build and install a dynafocal engine mount. Since N27MS does have a dynafocal mounted O-360 Lycoming, I have taken some pertinent dimensions off it, which should help you to duplicate it. **SKETCH OMITTED**

CP24, Page 8

LONG-EZ PITCH TRIM SYSTEM, can be installed on a VariEze as an optional retrofit. Also, we are recommending it as standard for new construction VariEzes. The new system is a lever on the left armrest that actuates two springs driving the elevator tube on the left side of the fuselage. It has twice the authority of the previous system. Now you can trim hands off from the stall to over 160 knots. It is totally redundant from the normal pitch control system. If there were a failure of the pushrods or other pitch linkage parts, you could still fly home with the pitch trim. We have done approaches and landings without touching the stick, using throttle, rudders and pitch trim only. Install per the drawings shown. Retrofit requires removal of a portion of the left side console. Saw it out with a hacksaw blade, and patch with one ply BID tape. PTH and PTB are available from Brock. The springs are available from Aircraft Spruce and Wicks.

STEP 1
Mounting block - PT 1. Fabricate from 1/4" 5 ply birch plywood, see full size pattern. Locate PT 1, dremmel away the skin to clear the AN3 bolts (section A-A). Install the bolts, then bond PT 1 to the fuselage side with flox. Cover with 1 ply of BID that laps 1/2" onto the fuselage side, cure.

STEP 2

Fabricate PTH, PTB, and two PW's or purchase them pre-fabricated from the distributors. PTS (pitch trim springs) should be .350" outside dia. x .050 wire dia. cut to 6" (unstretched) and installed stretched to 9" long.

STEP 3
Cut two 20" lengths of 7 x 7 x 1/16" dia. aircraft cable. Using two AN100-3 and two 18-1-C sleeves, swage one end of each cable to PTH. Install PTH as shown using all the hardware shown in section A-A. Cut two 2" lengths of nylaflow nylon conduit and flox into instrument panel holes. Thread the cables through and swage the ends at the 5.6" and 6.2" dimensions with the PTH handle at the neutral trim position.

Rivet PTB to the VECS2 as shown using two AN470 AD-4-5 solid rivets. For new construction, be sure to do this before attaching this trimmed VECS2 to the left elevator tube. For retrofit, you can carefully squeeze these solid rivets using a vise grip. Do it progressively, a little at a time. Do not use pop rivets. Be sure to check for adequate longeron clearance.

Install AN100-3 thimbles in the PTB elevator bracket. Sew the PTS springs on as shown with two loops of .041 stainless safety wire. Now install the canard and hook up the springs. The elevator should sit at zero degrees with the PTH handle at neutral trim. Cut the required slot to allow full travel and mark the "take off" position. Leave a 1" dia hole in the console to allow adjustment of the lower bolt to change friction. Adjust friction to just hold PTH at full aft trim with full forward stick. Springs should never be slack. If your trim is insufficient at either end of the range, you can make a minor adjustment by shortening one of the PTS springs, up to a maximum of 1 1/2" shorter. If this is still insufficient, your elevator contour is incorrect. Further trim authority must be done either by correcting elevator contour, or by adding a fixed trim tab to the elevators.
SKETCHES OMITTED

CP24, Page 9

DRAWINGS FOR PITCH TRIM SYSTEM OMITTED

CP24, Page 10

DRAWINGS FOR PITCH TRIM SYSTEM OMITTED

CP24, Page 11

WHICH ONE?

Rutan Aircraft Factory Inc., markets homebuilt plans for three different aircraft - The VariViggen, VariEze and Long-EZ. All three are two-place. The following information is intended to help you decide which is best for you.

PERFORMANCE AND UTILITY

The Long-EZ is the best in this category with range, altitude capability and performance way above the other two. Operation from high density-altitude airports at heavy weights is also best with the Long. The Long-EZ has the highest ceiling - a demonstrated 26,900 at light weights! Takeoff and landing distance of the Long is better than the VariEze and roughly similar to the VariViggen. Neither of the three are suited to unprepared fields, soft surfaces, gravel or small airports (less than 2000 ft, or 2400 ft with obstacles). Only the Long and Viggen are capable of night or IFR flying and only when properly equipped and flown by pilots with appropriate competence.

EFFICIENCY
The VariEze has the best miles per gallon, the Long coming in a close second and the VariViggen last. MPG at 75% power for the three are 35, 29, and 16 respectively.

CABIN/BAGGAGE
All three airplanes are soloed from front seat only. The VariViggen has two, similar, large, spacious cockpits with relatively upright seating. Large enough for 6 ft-5 in pilots. Two or three average-size normal suitcases fit the large baggage area aft of the rear seat. The cabin size and baggage room is much larger than the VariEze or the Long.

The VariEze and Long have two cockpits that are not similar. The front seat allows stretch-out comfort for pilots up to 6 ft-5 in, with carefully engineered thigh, lumbar, armrest and head support. The VariEze and the Long-EZ front seats are better suited to long-range comfort than the VariViggen seats. However, the VariEze and Long-EZ rear seats are smaller and less comfortable than the VariViggen. They can fit a 6 ft-4 in person, but comfort is compromised above 5 ft-10 in.

The Long-EZ baggage areas include two special suitcases, two cabin-accessible wing strake areas and additional room over the rear seat and in the wing spar. Total volume is nearly 10 cubic feet, however soft-type luggage must be used. Normal, hard suitcases do not fit. The VariEze has baggage room limited to the two special suitcases, approximately 3 cubic feet.

The VariViggen has center control sticks, rudder pedals and throttle in both cockpits, arranged much like a modern fighter. Conventional toe brakes are used. The VariEze and Long-EZ have side-stick controllers in both cockpits, but rudder pedals and engine controls only in front. Their rudder pedals work the two rudders independently and actuate the wheel brakes after full rudder is reached, i.e., one simple pedal for rudder and wheel brake.

CONSTRUCTION
None of the three require special skills or elaborate tools, since prefab parts are available for complex components. The VariViggen is by far the most demanding to build for several reasons: retractable landing gear, electric aileron reflex controls, full dual cockpit controls add a considerable number of parts to build. The mix of wood and composite structure requires different skills and tools. Control system includes many parts. Total building time can run from 3000 to 4000 hours, approximately 3 to 5 years of spare time effort.

The VariEze has been built by homebuilders in as little as 550 man hours and 4 months. However, projects on the average run closer to 900 to 1200 man-hours and 1 to 1.5 years spare time. The Long-EZ requires about 10 to 20 percent more work than a VariEze.

Any of the composite work (complete Long-EZ, VariEze and VariViggen outer wings) requires a clean shop that is controlled to a temperature range of 70 to 90 degrees and that allows work without direct sunlight on the part being built. Minimum shop size for Viggen, Long and VariEze is 400, 300, and 250 sq. ft. respectively.

ENGINE SIZE
The VariViggen, designed for the 273 lb 150 hp Lycoming is limited to the 150, 160, and 180 hp Lycoming engines. The lightweight, fatigue-free fixed pitch wooden props must be used. Heavy metal props make it (and the VariEze and Long) tailheavy, and increase risk of prop failure. Use of the 180 hp or injected 160 hp Lycomings on a VariViggen will result in a requirement to carry nose-ballast.

The Long-EZ is limited to the Lycoming O-235 (108 to 125 hp) and Continental O-200 (100 hp) with any accessories. The Lycoming is preferred, since it has a fuel pump and longer overhaul life.

The VariEze is intended for the lightweight Continental A75 and A80 engines. The C-85, C-90 and O-200 can be adapted, but they must be stripped of accessories to avoid an overweight, tailheavy airplane.

STALL CHARACTERISTICS
All three aircraft are designed to be "stall proof", i.e., they can safety maneuver up to, and including, full-aft-stick without experiencing a stall break, departure, or loss of altitude. They can all climb at the full-aft-stick speed, Long-EZ being the best (900 ft/mn at gross), Viggen the least at about 400 ft/mn. Homebuilder experience has shown that most VariEzes have excellent stall characteristics but a few experience wing rocking and roll-off at the stall. This is not expected with any of the Long-EZs, since they were designed with a greater margin of stall for the rear wing. Our prototype Long has proved to have exceptionally docile high angle attack characteristics, resisting departure for any maneuvers including tailslide stall entries, and application of all combinations of rudder and aileron. The VariViggen also has a good stall margin, with its standard wing configuration, however, with its special performance-wing its stall margin is low, resulting in more conventional characteristics, i.e., at minimum speed the S.P. wing will drop if the pilot sideslips.

MANEUVERABILITY
The VariViggen excels here, with its high roll rate and tight turning capability. However, due to its low aspect ratio, the Viggen looses speed in maneuvering. Thus, for sustained maneuvering, the Long is the best - it can climb over 400 ft per minute while maintaining 2-g at gross weight! The VariEze has the lowest roll rate. All three types are noted for their good maneuverability, as compared to conventional aircraft.

PILOT SKILL REQUIRED

The VariEze's high approach and landing speeds and responsive controls put more demands on pilot proficiency than the Viggen or Long-EZ. The Viggen has a relatively large trim change with power application. (nose up when power is reduced), requiring pilots attention. The VariEze and Long-EZ have very small trim changes for power, gear extension and landing brake extension. A VariEze or Long-EZ can fly for extended periods with "hands-off" controls. A Viggen must be continually flown. For those reasons the Long is the most docile, easiest for fly, and safest for the low-proficiency pilot.

Crosswinds - due to its responsive roll rate, high available sideslip and wide landing gear, the Viggen can handle the most crosswind. Takeoff and landing in wind components well above the capabilities of conventional airplanes are relatively easy. The Long-EZ is next, capable of handling a 20-knot component. Due to lower roll rate and lower wing tip clearance, the VariEze is last for crosswinds.

VISIBILITY
In order of preference - Viggen, Long and VariEze.

COST
Refer to the respective sheets for a breakdown of costs to build each airplane.

LONG-EZ

FAST - EFFICIENT - HIGH UTILITY - LONG RANGE

Long-EZ N79RA with 75 gal. back seat tank during the world distance record flight. **PHOTO OMITTED

THE AIRPLANE
The Long-EZ is a small, high-performance, high-utility homebuilt sportplane. While recommended mainly for Day-VFR operation, competent pilots can also equip it for night and IFR flying. Power plant is either the 0-235 Lycoming or the 0-200 Continental. It has an alternator-powered electrical system and can be equipped with electric engine starter. It's cockpit layout is designed to compliment pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wing strakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 P.V. core foam. (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core reducing complexity, increasing contour stability, and improving corrosion resistance. As

compared to conventional metal or wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

TRAVELLING MACHINE
At last, an airplane that is specifically developed for efficient, high speed, long-range travelling with room for two adults and plenty of baggage. Fuel allowance with two adults is 38 gallons. Single-place, you can carry 52 gallons! If you're in a hurry, you can cruise at 75% power at 8000 ft at 185 mph (161kts), burning 6.51 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles), in 5.2 hours with a 40 minute fuel reserve. If you're not in a hurry, you can cruise "economy" at 12000 feet at 144 mph (125 kts), burning only 3.52 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 10 hours with a 40-minute fuel reserve. Single place, using the entire 52-gallon fuel capacity, stretches the maximum range and endurance to over 2000 miles and 16 hours!

The high efficiency, long-range capability increases a pilots options for fuel availability and weather detours. The fact that the Long-EZ can carry the same load and fly as fast as other 160-180 horsepower aircraft, means large fuel savings - 29 mpg at fast cruise, 41 mpg at economy cruise.

UNUSUAL EFFICIENCY
The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a worlds distance record, and landing with enough fuel to surpass 5000 miles. At that, it's capability was not taxed - it's initial climb rate was over 600 ft/mn! At light weight, it climbed to 27000 ft in still air - an altitude unheard of for a fixed-pitch, non-turbocharged airplane. Our Long-EZ is so efficient, the engine can be shut down while at 5-ft altitude over the numbers at only 120 knots, then it can pull up, fly at 360 degrees pattern and land on the same runway - completely without power! It's power-off glide angle is only 3.7 degrees - thus a belly-mounted drag devise (landing brake) is used for landings.

SUPERB FLYING QUALITIES
Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and safe stall characteristics. It can be maneuvered sharply, even to full aft stick, without fear of stall or spin. Flight tests show the prototype to be free from stall departures and spins for all types of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed.

Trim changes due to power, gear retraction or landing brake are all very small. It's wide cg range allows a large range of pilots or passengers weighing up to 240 lbs.

The Long-EZ's approach and landing speeds are 75 mph (65 kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.

THE HOMEBUILDER SUPPORT
The Homebuilder support. The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

THE TEST PROGRAM
The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

COST AND BUILDING TIME
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, VFR instruments, plumbing, tools, tires, wheels, brakes and upholstery (cushions and special suitcases) costs about $2,900. Any of these items can be purchased separately. We strongly recommend that you get the distributor's catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

The S-glass roving molded structural fiberglass main gear and nose gear are available from RAF, at $277.95 and $49.75 respectively. Many other prefab parts ranging from propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased from the listed manufactures. All those prefab parts cost approximately $1,600 - and using them, the competent builder can build a Long-EZ in as little as 800 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above cost of the prefab items. Contact the manufactures for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

Engine costs vary widely. Our prototype has an 0-235 Lycoming that had 1400 hours, when purchased for $1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from $3000 to $6000. Engine accessories, such as instruments, prop extensions etc cost about $300 to $500. In summary then, total cost can run from $5300 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $9900 for everything available purchased and a zero-time engine. IFR avionics can add from $2000 to $15,000 to those numbers, with many options available.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.
Empty Basic	710 lb.
Empty Equipped	750 lb.
Solo Weight	960 lb
Gross Weight	1325 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	550/830 ft
Climb (solo/gross)	1750/1350 fpm
Cruise 75% 8000 ft	183 mph
Cruise 40% 12000 ft	144 mph
Max range * 75% (solo/2 place)	1370/965 mi
Max range * 40% (solo/2 place)	2010/1430 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200
SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds

		only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIA Continental	19.00	21.00
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order. Newsletter not taxable.		
TOTAL		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $3

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $2

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $2

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Sally Melvill taxiing out for first Long-EZ solo flight.

Long-EZ parked nose-down with two VariEzes.

The nose gear retracts for parking and in flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

VariEze

FAST - EFFICIENT - FUN

PHOTOS OMITTED

THE AIRPLANE
The VariEze is a small, high-performance homebuilt sportplane. It is recommended for day VFR operation only. The power plant is the A-75 or A-80 Continental. The airplane is not alternator equipped. A basic electrical system can be installed to run a NavCom and standby gyro instrument. This electrical system is powered by a solar panel and/or ground-charged. Additional electrical instrumentation, electrical engine starter, and night lighting are not recommended.

Larger Continental engines, up to 100 hp (C-85, C90 and 0-200) can also be used, but their accessories must be removed (starter, alternator and vacuum pump) to provide adequate useful load and proper aircraft balance.

Cockpit layout is a sidestick on the right console, rudder pedals/brakes and throttle and optional landing brake on the left console. A backup sidestick is located in the rear cockpit. A small amount of baggage can be carried in two special suitcases.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core, reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal or wood, composite-sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

EFFICIENT DAY-VFR UTILITY
In addition to fun recreational flying, the VariEze can be used for VFR cross-country flying. Its range, single place, using the full 26-gallon fuel supply is 750 miles plus 45 minute reserve. Two place, with 15 gallons fuel, the range is 430 miles plus 45 minute reserve. Economy is excellent - 35 mpg at 177 miles per hour and 42 mpg at 140 miles per hour. Complete range and performance data is shown in the Owners Manual.

UNUSUAL EFFICIENCY
The VariEze uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. At light weight, a VariEze powered by an 0-200 has climbed to over 25,000 ft in still air - an altitude unheard of for a fixed-pitch, non-turbocharged airplane.

GOOD FLYING QUALITIES
Development of the VariEze included flight testing of many refinements to optimize flying qualities. It is a solid, stable airplane that has responsive elevators and ailerons, good turbulence response, excellent "hands off" stability and safe stall characteristics. It can be maneuvered sharply, even to full aft stick, without fear of stall or

spin. Flight tests show the prototype to be free from stall departures and spins for all types of entries. Climb is excellent, even at the full-aft-stick speed. Trim changes due to power, gear retraction or landing brake are all very small. It's cg range allows a range of pilots or passengers weighing from 150 lb to 220 lb. Lighter pilots generally require the addition of ballast. The VariEze's approach and landing speeds are 85 mph (75 kts) and 70 mph (60 kts) at normal landing weights. The approach and landing are at a faster speed than average light planes. Forward visibility is inadequate, thus, the airplane is landed at about 10 knots above its stall speed. Pilots should be competent and proficient in several types before VariEze check out.

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The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan Newsletter, the "Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

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Engine costs vary widely. A partially runout A-75 can cost as little as $1500. Newly overhauled engines can cost from $2000 to $3500. Engine accessories, such as instruments, prop extensions etc cost about

$300 to $500. In summary, the total cost can run from $4300 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $8500 for everything available purchased and a zero-time engine.

VARIEZE DOCUMENTATION is available in six sections.

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also the complete plans and construction manual for the VariEze except engine installation. The manual consists of a 153-page, bound 11" x 17" book plus nine larger full size drawings. It includes 168 photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane. The manual identifies sources for all materials and all prefabricated components. NASAD approved.

SECTION IIA - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

SECTION III - ELECTRICAL - This is an optional (not required) set of drawings and installation instructions for electrical system.

SECTION IV - OWNERS MANUAL - This is an operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

SECTION V - FINISHING THE COMPOSITE AIRCRAFT - Applies not only to a VariEze, but to other epoxy/composite aircraft. Includes filling/contouring priming/U.V. barrier/color and trim.

SECTION VI - LANDING BRAKE - Complete full size drawings for an optional drag device. The brake dramatically increases the airplane's glide angle and deceleration in the flare. Without the brake the airplane is limited to runways at least 2400-ft long. With it, runways down to 1800-ft can be used with appropriate pilot proficiency.

Brief VariEze Specifications/Performance. Engine A-80 Continental (complete data in Owners Manual).

Span	22.2 ft
Area	66 sq. ft
Empty Basic	570 lb.
Gross Weight	1000 lb.*
Max Fuel	26 gal.
Cabin L/W/H	100/22/36 in.

* 1050 with 0-200 Continental

Takeoff (solo gross)	900/1200 ft
Climb (solo gross)	1200/900 ft
Cruise 75% 8000ft	177 mph
Cruise 40% 12000ft	135 mph
Max range *75% (solo/2 place)	750/430 mi.
Max range *40%	900/540 mi.

Ceiling (solo/gross)	17000/14000
Landing dist. (solo/gross)	700/900 ft

* 45-minute reserve

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF VARIEZE MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS AND COWLINGS.

Near Los Angeles	Near St. Louis
AIRCRAFT SPRUCE,	WICKS AIRCRAFT SUPPLY
201 W. Truxlow Ave.	410 Pine Street,
Fullerton, Ca 92632	Highland, Ill 62249
(714) 870-7551	(618) 654-7447
Catalog $3	Catalog $2

KEN BROCK MANUFACTURING, 11852 Western Ave, Stanton Ca. 90680 (714-898-4366 - Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $2

THE AIRPLANE FACTORY, 7111A Brandtvista, Dayton, Ohio 45424 (513) 845-9872. Plexiglass canopy bubble.
Send SASE

Check items desired	Price, includes first-class mail U.S. & Canada	Air Mail Overseas*
Rutan Aircraft info kit includes current issue of "Canard Pusher" newsletter.	$ 5.00	$ 6.00
"Canard Pusher" newsletter published quarterly. One year subscription.	6.75	8.75
Section I	139.00	153.00
Section IIA	19.00	21.00
Section IIC	21.50	23.50
Section III	8.00	9.50
Section IV	8.00	9.50
Section V	7.00	8.00
Section VI	10.00	11.00
3" tri-color jacket patch.	1.95	1.95

ADD 6% if California resident. Newsletter is not taxable.

VARIVIGGEN

FULLY RETRACTABLE, FIGHTERLIKE, HIGHLY MANEUVERABLE.

PHOTOS OMITTED

EXCELLENT UTILITY.

Comfortable tandem cockpits, three-suitcase baggage area, and an adequate cruise speed provide unusual utility for a homebuilt airplane. It's road-towable with outer panels removed.

PROVEN DESIGN
Complete flight test program completed; 600 hours on prototype with very little maintenance. Won the Stan Dzik trophy for design contribution, Oshkosh '72, the Omni Aviation Safety trophy at Oshkosh '73 and the outstanding new design award at Oshkosh '74.

STALL/SPIN SAFETY
The VariViggen's safe flying qualities have been the subject of technical presentations for EAA, SAE, AOPA, and AIAA. It will not stall or "mush in" like the common delta. At full aft stick (43 kts) it will still climb 500 fpm, roll over 50 degrees per second without rudder co-ordination, and make buffet-free turns. The standard-wing VariViggen is highly stall/spin resistant. The Special-performance VariViggen can be stalled if sideslipped at low speed.

FLYING QUALITIES
The Viggen flies similar to conventional aircraft, with the following exceptions: higher roll rate, ability to tightly maneuver without stall, and trim change due to power change (nose rises unless checked when power is reduced). The Viggen can handle crosswinds that exceed the capability of conventional light planes.

UNCOMPLICATED DESIGN
The basic structure requires few special tools and can be built in a simple jig. The few parts that have double-curvature are available in fiberglass, ready to install. All machined and welded parts are available. Due to the many systems and wood structure, building time is not short. Allow 3000 to 4000 man hours.

COST TO BUILD
Raw materials - approximately $3000. Prefab parts - approximately $2800. Engine - $500 to $3500. Instruments - approximately $500. Total cost can run from $6000 (owner built prefab parts and half run out engine) to about $9500, plus avionics.

THE FOLLOWING DISTRIBUTORS MARKET VARIVIGGEN PARTS.

AIRCRAFT SPRUCE AND SPECIALTY CO.
Box 424, Fullerton, Ca 92632
(714) 870-7551
VariViggen Spruce kit, plywood kit, hardware, aluminum and fiberglass, Catalog - $3

KEN BROCK MFG. 11852 Western Ave, Stanton, Ca 90680. (714) 898-4366
VariViggen prefabricated components, all machined parts. Catalog - $2

THE AIRPLANE FACTORY, 7111A Brandtvista Ave., Dayton, Ohio 45424.
(513) 845-9872
VariViggen plexiglass canopy.

MONNETT EXPERIMENTAL AIRCRAFT INC., 955 Grace Street, Elgin, Il 60120
(312) 741-2223
VariViggen molded fiberglass parts.

GEORGE EVANS, 4102 Twining, Riverside, Ca 92509
VariViggen welded nose and main landing gear, 1 1/4" sq. steel tube.

JESSE WRIGHT, (VariViggen builder)
7221 S Colorado Ct, Littleton, Co 80122 (303) 771-5140
VariViggen prefab wood parts. Send 50 cents for list.

Performance with	Takeoff	850 ft
150-hp, fixed	Climb	800 fpm
pitch prop, gross	Cruise	150 mph
weight	Full Aft stick	49 mph
Standard Wing	Landing	500 ft
Performance with 150-hp	Climb	1000 fpm
Special Performance Wings	Cruise	158 mph
Specifications	Canard Span/Area	8 ft/18.3 square ft
Standard VariViggen	Wing Span/Area	19 ft/119 square ft
	Empty Weight	1050 lb
	Gross Weight	1700 lb
Specifications	Wing/Span Area	23.7 ft/125 square ft
Special Performance Wing	Gross Weight	1700 lb.

The following documentation is available:

VARIVIGGEN TECHNICAL REPORT. Complete tech. report describing the VariViggen two-place sportplane. Includes specifications, pilot report, dimensions, 3-view stability and performance flight test data. Description of car-top wind tunnel. 8" x 10" glossy photo and current issue of newsletter. Price - $10.00 first class mail, $11.50 Airmail overseas.

VARIVIGGEN OWNERS MANUAL. Complete operational handbook including normal and emergency procedures, loading, operational record keeping. Price - $6.00 first class mail. $7.50 Airmail overseas.

"CANARD PUSHER" SUBSCRIPTION. A newsletter designed with the builder in mind. Emphasis on distributing to all builders as many ideas, improvements building tips, photographs, and flight reports as possible. Details mandatory, desirable, and optional changes to plans and to owners manual. A newsletter subscription is mandatory for those with VariViggens under construction. Published quarterly. Price - $6.75 first class mail. $8.75 Airmail overseas. Back issues, $1.50 each.

VARIVIGGEN PLANS - SECOND EDITION. This is an updated, revised set of very complete drawings and construction manual consisting of a bound 11" x 17" book, containing many photographs, hints and instructions based on actual builders experience over the past several years. It covers the entire airplane, including the engine installation, fuel system, and not only covers the original standard wing in both aluminum and foam and fiberglass composite, but it also includes the composite S.P. wing, ailerons, and rudders. The manual identifies sources for

all required materials and all available prefabricated parts and components. Price - $165.00 first class mail. $177.00 Airmail overseas

VARIVIGGEN R/C MODEL PLANS. Complete construction plans for the 18% - size radio-controlled model airplane built and flown to evaluate VariViggen spin characteristics. Designed for 4-channel proportional radio equipment and engine in the .35 to .65 cubic inch size. 555-sq inch wing area. Price - $4.75 first class mail. $5.50 Airmail overseas. Note - Add 6% tax for California orders.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

These two models were built by NASA for wind tunnel testing. Lower photo is a rotary balance test in NASA's spin tunnel. The VariEze has been confirmed to have spin resistance far superior to conventional aircraft. Tests were conducted up through 90 degrees angle-of-attack (flat spin).

Roger Houghton at RAF. Roger produces the S-glass main and nose gear struts for Long-EZ and VariEze. New method accurately proportions the epoxy for a perfect resin-to-glass ratio.

Glass EZ by Mary Meide.

Mule Furgeson's EZ.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dick in Long-EZ doing his thing.

Sally Melvill - First solo - Long-EZ.

A typical Saturday at RAF.

Dick checking out Don Downie.

Les Faus - Long-EZ check-out.

Burt - Down under - Jeff Danes.

Barry and Mary Schiff, after first Long-EZ flight.

Dallas, Texas.**"LONG-EZ AUTO LICENSE PLATE**

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THE CANARD PUSHER NO 25 JULY 80

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 25. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 25. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 25. If you are building a VariEze from 2nd Edition plans you must have newsletter 16 through 25. If you are building a Long-EZ from 1st Edition plans you must have newsletter 24 and 25.

A Current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave CA., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

Saturday Demos - Every Saturday (except as shown below) RAF conducts a demo at our shop at the Mojave Airport.

We start the presentation/discussion at 10 am each Saturday with flight demos of our experimental aircraft at approximately noon (weather permitting). This will be done each Saturday except when we will be gone to the following airshows:

2 Aug	80	Oshkosh, Wisc.	EAA Convention
9 Aug	80	Oshkosh, Wisc.	EAA Convention
4 Oct	80	Tullahoma TN	EAA Convention

Bring any of your parts for inspection. We are located near the west end of the flight line at the Mojave Airport about 2 hours drive north of Los Angeles on Highway 14. When arriving at Mojave by car turn east at the Carls Jr restaurant to find the airport.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to keep it separate from a request for an answer to a builder question.

Mark the outside of your envelope "builder questions". This will speed your reply.

RAF ACTIVITY - Since CP 24 has included development of grassfield/rough field capability for the Long-EZ, development of a fuel pump system for the O-200, new pilot checkouts in the Long-EZ, finishing up the Long-EZ owner's manual, and several consulting jobs.

LONG-EZ/VARIEZE PREFAB GLASS PARTS
We are very pleased to report that our new manufacturer is in production on nose wheel wells, strut covers, sump blisters (Long-EZ) and cowlings. He is also working on tooling for wheel pants and looking into making tooling for wing tanks (strakes) on both VariEze and Long-EZ.

The quality of all the parts is outstanding. The first new parts will be shipped to our suppliers starting July 7th. The tooling has been completely redone and is first class. The cowls, direct from the mold are shiny white gel coat finish and may not even require paint.

LONG-EZ OWNER'S MANUAL
The Owner's Manual is now available from RAF, and is an excellent place to go for Long-EZ performance, range, etc. Note: unless otherwise specified all speeds shown in the manual are in KNOTS.

NOTE: RAF WILL BE CLOSED 1 AUGUST 1980 THROUGH 12 AUGUST 1980 FOR OSHKOSH.

FIRST HOMEBUILDER'S LONG-EZ FLIES!!
Johnny Murphy, that prolific builder pilot from Cape Canaveral, Florida is now flying his Long. He and son Steve plan a non-stop flight to Oshkosh 80, weather permitting. Johnny has built one of the first VariEzes and Quickies also!

The adjacent photos show the six-g static load test Johnny conducted on his Long to assist RAF in confirming the structure. Strain gages confirmed only about 50% of allowable stresses were reached at six-g, with a wing tip deflect of 8.5 inches (21.6 cm).

He also reports it holds 55 gallons of fuel and gets off in 700 feet on a hot day with full fuel. Johnny says his Long is faster than his VariEze.

As of July 2nd, Johnny has eight hours on the airplane and has had three other pilots fly his Long, because he says it is "so easy to fly".

PHOTOS OMITTED

DICK AND MIKE'S LONG-EZ's By Mike Melvill
We like the Long-EZ so much that Dick and I decided to get together and build two of them. We rented a building, fabricated a couple of tables, the wing jigs and centersection spar jig and ordered complete raw material kits from Aircraft Spruce and complete prefab parts from Ken Brock. We picked up the parts and materials on June 14th. Since this is our own project and we are doing it as a recreation and hobby type thing, we only work on them during our spare time, after work and

weekends. Today, 12 days after receipt of kits, we have two fuselages assembled and glassed on the outside with speedbrakes and are laying out centersection spar parts. We are building them as quickly as possible, as we both want them for economical transportation machines, and we would like to have them flying as soon as possible. Neither of them will be "Grand Champion Quality" by any stretch of the imagination, rather they will be "plain vanilla" Long-EZ's built as light as possible to be flying as soon as possible. I have obtained an engine already, a Lycoming O-235 L2C, 118 hp at 2800 rpm out of a wrecked Cessna 152. Unfortunately this engine is not ideal for a Long-EZ in that it does not have a fuel pump, and does have a full-flow spin-on oil filter. The filter projects 1" into the centersection spar, and a fuel pump is mandatory on a Long-EZ. I am currently looking for an O-235-C accessory case! The O-235 L2C come as above only from Cessna 152's. The same engine from a Piper Tomahawk or Grumman trainer is fine and does have the fuel pump. Dick is still looking for an engine for his Long-EZ. We will continue to report progress on our two Long's in future Cps.

HOSPITALITY CLUB FLYINS

Kern Valley Airport, Kernville, Ca
May 31st - June 1st.
Twenty five member airplanes flew in from all over the west. The weather was great, the campsite good, the hospitality provided by the airport was outstanding, extending to a really excellent bacon and eggs breakfast grilled out doors on Sunday morning.

The "dawn patrol" certainly woke everyone up with fly bys over the campsite, much too early for me at least!

Burt and Dick's grandfather, Mr. Goforth, 91 years old, went for his first ride in a small plane when Dick took him up in the Long-EZ. Several people sampled the thrills and "chills" of the whitewater in the Kern River, and good times were enjoyed by all.

Saturday evening was the highlight. We all went to dinner at the "Ewings" restaurant in Kernville and after a little dancing, returned to the airport where Bill Brackett gave a most enjoyable impromput show. Bill is a talented musician and a very funny comedian.

Once again, the Hospitality Club flyin proved to be really outstanding.

Burt's Surprise Birthday
June 21st
Mojave Airport was the sight of the most recent Hospitality Club flyin. Burt was kept in the dark about it and was not aware of anything until he drove in at around 11:30 am on Saturday morning. There were 25 VariEzes parked in front of the RAF hanger, surprise!!!

Several people flew in from considerable distances, Norm Ross from Victoria, Canada, Charlie Richie, Los Cruses, NM, and Gary Johnson from El Paso, TX to name a few. The San Diego contingent arrived in style

with a 5 ship flyby. They have 14 VariEzes flying and 28 under construction in the San Diego area!

An excellent chicken dinner was catered in the RAF hangar; where much "hangar flying" was conducted. Over 120 people flew or drove in, and again a great time was had by all.
Dues - Just a reminder, the dues for the club are $4.00 State side and $6.00 overseas.

VARIEZE HOSPITALITY CLUB FLYIN TO THE BAHAMAS
Bruce and Bonnie Tifft have been really working hard in getting all the information together for this Christmas trip. The plans are pretty well firmed up and for further info, please send a self-addressed-stamped-envelope to Bruce and Bonnie. The dates planned are December 27, 1980 through January 2, 1981. Blanket oks have been approved for VariEze flights to the Bahamas.

Bruce and Bonnie Tifft
8746 Ventura Ave,
Ventura, CA 93001

LBF RACE OSHKOSH 1980
We are looking forward to a great VariEze race this year and some interesting competition. It's not an all out full bore but a strategy race getting the most speed out of the least amount of fuel. Even if your EZ is not as fast as some of the others you still have a good chance of winning by good fuel management. So don't let that stop you from entering. If you haven't done so call the race director Mr. Aaron King immediately (404)355-6185 to get registered, the dead line is short.
Or write to: Aaron King
1893 Graystone Rd,
Atlanta, GA 30318
We have established a VariEze/Long-EZ class within the race with a $1500 cash purse to be split between the three best VariEze/Long-EZs. This is in addition to the $9000 purse given by the race organizer. For rules see page 14 in the May 1980 issue of Sport Aviation and CP24.

The following VariEze class sponsors each contributing $250 are Applied Plastics (epoxy formulations), Aircraft Spruce, Wicks Aircraft, Ken Brock Mfg, Herb Sanders (exhaust), and Rutan Aircraft. Plus any more I can line up before race time. Applied Plastics will also donate a safety laminating kit to each entry.
Don't delay do it now time is short. See you at race time.

PROPELLERS
We are happy to announce a new propeller company to add to our list of recommended propeller manufactures.

The Great American Propeller Co.
555 West Mont Drive #212
San Louis Obispo, CA 93401
(805)481-4450

We evaluated their 56 x 68 on the VariEze prototype N4EZ Continental O-200 and found it's performance to be as good or slightly better then anything we have tested so far. The quality of workmanship of the prop is excellent and should give good reliable performance.

We have been working with Bruce Tifft "B & T Propellers" trying to optimize a prop for the O-235 powered Long-EZ. We just completed an evaluation on his 60 x 66 prop and found a significant improvement in cruise speed (5 mph) without a loss in climb performance. Note, our airplane now is flying faster then the Owner's Manual data. Bruce's quality of workmanship is excellent and his unique leading edge protector make it impervious to rain erosion. Bruce's extra effort in this area is appreciated very much.

B & T Propellers
8746 Ventura Ave,
Ventura, CA 93001
(805)649-2721

MECHANICAL FUEL PUMP FOR LONG-EZ

The Long-EZ fuel system must have a mechanical fuel pump. The gravity fuel system used on the standard VariEze will not work on the Long-EZ. Most O-235 Lycomings and the Rolls Royce O-200/O-240's have pumps. The Continental O-200 and some Lycoming O-235's that came out of the high wing Cessnas don't have mechanical fuel pumps nor are the cases machined to accept them even if you had a pump in hand. So if you are looking for an engine be sure it has a mechanical pump. However, if you have a "blue" high wing Cessna engine you can adapt a pump by one of the following methods.

1. The most preferred method is to have the cases machined and install the cams and push rods as necessary to convert it to a standard mechanical fuel pump configuration. Check with a certified engine overhaul shop for the conversion. This method requires total engine tear down. The machining and parts are expensive. If the engine is in for overhaul have the modification done before reassembly.

2. We have been told that a Thompson Vane Type pump series # TF1900 will mount on the vacuum pump pod and provide the necessary fuel pressure. But we have not tested it. The pump is a standard aircraft pump with A.N. fittings but must be adjusted back to a lower 2-8 psi pressure. The pumps are somewhat expensive, but available. Contact Dick Davy at Precision Aero, 2749 E. Wardlow Road, Long Beach, CA 90801, (213) 595-6377 for the Thompson pump.

3. We are working with Rex Taylor from H.A.P.I. V.W. engines to adapt a Volkswagen fuel pump to run off the vacuum pump pad. We have a prototype of this conversion in service test on N4EZ and it's working satisfactorily at this time. However, the V.W. pump has automotive fuel lines, not aircraft A.N. fittings. This will be the least expensive method. Rex is also working up an adapter to run a standard aircraft AC fuel pump off the vacuum pump pad. You can contact Rex directly by calling (714) 357-6342. Note: This method is still in the development stage and may not prove satisfactory. We should have something more definitive next CP.

VARIEZE BOAT-TAILED EVALUATION

There has been a lot of interest in the "boat tail" since Steve Woods ran his in the VariEze race at the Sun-n-Fun. We obtained a boat tail shell from Ken Forrest and ran a very close evaluation to determine if there was any performance advantage to this modification. Our evaluation with and without the boat tail shows no perceptible difference in performance.

Steve Woods also has a NACA engine air cooling intake scoop which involves extensive additions to the fuselage and cowl. Steve has asked to make it clear that the flush scoop will not adequately cool the engine. Steve had to develop extensive baffling modifications to get the good cooling he now has. We are following Steve's developments and are particularly interested in his cooling baffle configuration.

MODIFIED LONG-EZ NOW APPROVED FOR GRASS FIELDS

Rutan Aircraft has recently tested a spring loaded "shock strut" which was installed in place of the NG-9/NG-10A rod on Long-EZ. This, combined with 500 x 5 main tires, was tested by progressively taxiing over 1" x 2", 2" x 4" 's and finally over two 2" x 4" 's, one on top of the other. The results showed a very significant increase in the rough-field absorption qualities of the landing gear. Taxiing over stacked 2" x 4" 's resulted in very acceptable loads, with a satisfactory ride.

We then flew N79RA to a average grass strip and conducted takeoffs and landing at a range of weights and cg positions. Also, taxi test in tall grass and undulating surfaces was satisfactory. A Long-EZ with the spring strut and 500 x 5 main tires is now approved to operate from average grass fields. This does not mean it is acceptable for gravel or unprepared/rough surface. The prop damage that can result from operating on gravel is unacceptable.

The spring strut is installed by simply removing the 2 bolts on the NG 10A pushrod and replacing it with the spring assembly. Additional clearance is required by trimming away a portion of the strut cover.

The spring is intended primarily for the Long-EZ, to give it the grass capability, however VariEze owners may want to install it to improve the rough field handling of the nose gear. The spring allows the gear to deflect aft and up when a bump or hole is encountered, and greatly reduces the loads on all parts (strut, NG10A, castings fork and wheel). The Long-EZ fiberglass strut is stiffer than the VariEze, thus the new spring is strongly recommended unless you plan to always operate from smooth surfaces. Without it, nose gear damage may occur from rough surfaces.

Note: This is not intended to provide grass field capability for the VariEze. Its faster takeoff/landing speed and inability to use 500 x 5 tires makes it unacceptable for grass.

The strut, ready to install, is being made available by Ken Brock. Ken will also stock the LST-6 spring for those wanting to build their own. Refer to the drawing in this newsletter. Several different spring configurations were tested until arriving at the 1.5 x 4" heavy duty

rectangular coil spring. If building your own, shim as required to obtain the specified 250 lb preload. The strut should not deflect when static with pilot in cockpit and full fuel.

A FUNNY THING HAPPENED ON THE WAY TO EZ COMPLETION
By Jud Bock Serial #738.
While doing some finishing work in the back seat, I decided to close the canopy to check the rear head rest. It felt great, so I went to open the canopy and lo and behold the safety catch in the front cockpit was working perfectly! There I was, all 210 lb of me, locked in the back seat with no tools or anything to reach the 4" more, required to release the catch. My wife had just gone shopping and was not expected back for three quarters of an hour. Did I panic? Hell yes, because I was getting warm (hot actually!), and I decided to use my head and tried to use mind power to move the catch. After that failure, I started thinking some more and it finally dawned on my dulled brain that I had shoes on, which I promptly removed one of and was out in less than 5 minutes.

In another instance the builder has no shoes on. He removed his pants, rolled them into a stick and used it to reach the catch!

With consideration of this problem we designed the safety catch to be mounted at F.S.57 on the Long-EZ. VariEze new construction should follow suit.

BUILDER ASSISTANCE
More names to contact for builder assistance:

Al Coha,
5173 Leo Street,
San Diego, CA Phone: 582-2137

Nat Puffer,
???? N Payne Ave,
St. Paul, MN 55117

Nat is also willing to check new EZ pilots out in his VariEze, and to do first flights in new EZ's, limited runway flights, but not including envelope expansion.

CHECK OUT EXPERIENCE IN THE LONG-EZ
To date 30 pilots have been checked out in the Long-EZ. Pilot experience ranges from student, private, military, aviation writers, VariEze and even the odd airline captain. No problems were encountered by anyone and all made the transition easily.

Pilots current in a VariEze were given ground systems briefing and turned loose. The more experienced pilots without VariEze time were given one turn around the pattern (instructor in the back) then turned loose. Since the Long-EZ has a more solid pitch response and a lower deck angle on landing than the VariEze there was much less pitch bobble and no high round out landings as in some VariEze check outs. There was still some tendency to push both rudders out, especially on the first take off, but since you don't couple to roll as much as the VariEze this never created a problem. The most common comment was how

long it took to slow down to pattern airspeed and how much it would float on landing especially if you were fast.

We check out and soloed two of our RAF low time pilots, Sally Melvill (Mike's wife) 150hr private pilot and Pat Storch (Burt's girlfriend), a 24 hour student pilot. At no time did the instructor need to take control to save/recover the aircraft. Both were soloed after 1.5 hours dual in the front seat (6 to 8 landings). Neither had any formal backseat dual. Since the instructor had no throttle or brakes in the back, enough time was spent on the ground making low/high speed taxi runs to be sure this area was mastered. Neither required more than 10 minutes in this area.

Sally is current in a Champ, Grumman Tiger and VariViggen. Pat had only flown the Tiger. Both girls are exceptional pilots, better capable than average for their flight time. The following is Pat's personal perception of her flight:

"Incredulous - that was my first feeling when they told me they wanted me to solo the Long-EZ. Tiny insecurities worked their way out in the form of protests. "But I'm only a student! I've only soloed one other airplane! I have less than 25 hours!" It seemed that I was the only one lacking in confidence, because they would not be dissuaded.

The day came when it was time to give it a try from the front seat. The cockpit looked foreign, almost hostile. Instruments were not where my eyes wanted them to be. Throttle and stick were in the wrong hands. With my heart in my mouth, we started the pattern work. Soon I was thankfully too busy to be nervous, but I still felt I was reaching for an unattainable goal. Control of the Long felt so different, and the full-stall landings I had practiced so diligently in the Tiger were to be forgotten.

Then, amazingly, little pieces started falling together. Each landing felt better, the cockpit looked more familiar and a tiny seed of confidence started to bloom. Could it be? Would it really happen? Down to refuel and then came the words I wanted to hear - "you're ready to go!". My heart was racing once again but this time it was from anticipation and excitement. Lined up on the runway, I took a deep breath and was rolling. The take-off was smooth and felt good. The plane felt fantastic. I played in the sky. Up, down, around, turns and steep turns to 2 g's. I never expected any experience to equal my first solo, but this surely surpassed it. Flying never felt so good! Then came the final test, the landing. A little long, but a good one.

A Long-EZ pilot! I flew the Long! I wanted the world to celebrate with me. Flying had taken on a new dimension. I may have landed, but I was still in the air, and haven't come down yet. What a satisfying, exhilarating experience".

CAUTION - AMATEUR DESIGN
In 1977 an amateur designer/builder highly modified a VariEze with all-flying canard and other modifications. It crashed on its first tests, injuring its designer test pilot. Recently a new design, with the outward appearance of a VariEze, crashed on its first flight attempt, killing the pilot (a professional Cessna test pilot).

If you are contemplating a new design or modifications to an existing design be sure you understand that aerodynamic design, particularly for tandem wing configurations, is an engineering discipline that requires the appropriate analysis and test before risking ones life.

RETRACTABLE LANDING TAXI LIGHT INSTALLATION DRAWINGS FOR LONG-EZ - are new being shipped with Long-EZ plans. If you did not get this drawing with your plans, send a self-addressed-stamped envelope to RAF. This drawing is too large for the newsletter.

CONTINENTAL O-200 OIL BREATHER
Last winter we modified the configuration of the oil separator and location of breather outlet on N4EZ. This configuration is successful in scavenging all oil - none spills out the breather. It is plumbed as follows:

SKETCH OMITTED

BAFFLE HOLE IMPROVES CONTINENTAL ENGINE COOLING
Several VariEze owners have opened up a hole in the left-front baffle to improve cooling of the #1 cylinder exhaust port area (Continental only). This is in a position where, due to the locally low height of fins, the baffle does not otherwise allow enough airflow. See sketch. This hole allows direct impingement of cool air on the head just above the exhaust port. Center the hole over the area that is devoid of fins.

SKETCH OMITTED

OPTIONAL LONG-EZ LAYUP CHANGE SAVES WEIGHT
The following approved layup change on the Long-EZ centersection takes advantage of the better structural efficiency of oriented UND as compared to woven BID. These changes are easier to layup and save 3.5 lb weight!

Page	Layup	Old	New
14-2	5	3 Ply BID @ 45degrees	1 Ply UND @ 45degrees 1 Ply UND @ -45degrees
14-3	6	3 Ply BID @ 45degrees	1 Ply UND @ 45degrees 1 Ply UND @ -45degrees 1 Ply UND @ 45degrees 1 Ply UND @ -45degrees
14-4	8	3 Ply BID @ 45degrees	1 Ply UND @ 45degrees 1 Ply UND @ -45degrees

Note: UND cloth is butted, not overlapped at selvage edges. Be sure alternate plies of UND cross at 90 degrees fiber orientation to each other.

FIREWALL - LONG-EZ AND VARIEZE

We now approve the use of fiberfrax (a space age ceramic material) as a replacement for asbestos. Since fiberfrax is as good a fire barrier as stainless steel, we approve substituting .016 2024 T-3 aluminum for the stainless. This saves almost 2 lb at the firewall. Both Wicks and Aircraft Spruce are now shipping kits with fiberfrax and aluminum.

Installation of fiberfrax is as follows: Complete airframe construction through cowling installation, then remove everything from the firewall bulkhead, and install fiberfrax with a bead of silicone around the edge of the bulkhead. Do not wet out fiberfrax with epoxy. Now install the .016 2024 T-3 aluminum which is required to protect the fragile fiberfrax, from local damage, abrasion etc. See plans changes section of this newsletter.

VARIEZE FUSELAGE TANK VENT CONFIGURATION
Al Coha reports that unacceptable low pressure on his flush vented fuselage tank has resulted in fuel starvation. This was revised to a ram probe, solving the problem. Vent pressure measurements have confirmed that a ram type probe should be used on the fuselage tank. For new construction install a 1/4" aluminum tube inside the top of the fuselage tank and bring it out through the top and bend it 180 degrees to face into the breeze at least .6" from the top skin. For existing airplanes, it would work to install an aluminum tube into the fuel cap (see sketch), however there will then always be the danger that the cap may inadvertently be installed backwards, whereupon the fuselage tank may be rendered useless.

SKETCH OMITTED

PV FOAM AND WEIGHT CONTROL
The original PV core foam, type R45 dark blue, that we tested here at RAF, layed up absolutely perfectly without using slurry. Based on this series of tests, we called out no slurry on type R45 PV foam in Long-EZ plans. The production type R45 PV foam in most cases is representative of our test samples, however in a few cases larger cell foam is being delivered in the kits. This large cell foam is structurally excellent, and can be layed up without slurry with real acceptable physicals, however it is a lot easier to accomplish the layup if you slurry the type R45 PV foam. The glass wets out quicker and you get less air or dry looking areas. There is little or no difference structurally, but our test have shown a slightly lighter part if you use slurry. The best thing to do is conduct your own test as you build and decide for yourself which way works best for you.

In all cases your glassing time should not exceed 2 minutes per square foot per ply, i.e., front side of front seat bulkhead, is two plies, and should take no more than half hour. If you are working slower than this you are doing something wrong, and you will end up with poor work, heavy parts etc., due to epoxy gel. Above all, don't leave excess epoxy in a layup. If a squeegee can remove epoxy, do remove it. Use numerous squeegee passes to wet out as well as to remove excess. Remove the grams of excess epoxy from every layup, and your airplane will be many pounds lighter and stronger.

Do not add extra glass anywhere. One VariEze builder wanted his airplane "extra strong" so he added a ply here and there. His airplane

is over 100 lb. overweight and his strength for flight and landing loads is less.

Chase after grams, and the pounds will take care of themselves. Bill Lear once said he would kill his grandmother for a pound. While this measure is not recommended, it is possible if you are not diligent on weight control throughout your project you will be building a sluggish, single-place airplane.

REFERENCE LONG-EZ CHAPTER 14, STEP 13
At least a couple of you Long-EZ builders may have noticed by now that, due to the kink in the centersection spar it interferes with the aft seat bulkhead when you try to slide it into the fuselage. Do not remove the firewall to clear this. Using a coping saw, remove a triangular piece of the back seat bulkhead about 1" deep at the center and tapering to zero at the sides. After the spar's in place this piece is installed with wet micro and is structurally tied in by the tapes that lap onto the spar. For new construction do not permanently install the plywood firewall bulkhead in Chapter 6 or 7. Put the spar in from the back in Chapter 14, then install the plywood firewall bulkhead, lapping 1 ply BID around all edges.

CP25, Page 4

HOT WIRING
Important - do not substitute lighter tube than the 1/2" dia. steel tubes for the hot wire saw. The wall should be at least .049. The hot wire must be tight to operate without wire lag. Tighten till the stainless wire starts to yield (tone no longer increases when "strummed", as you tighten).

BUILDER HINTS
You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. This works great for hotwire templates too.

Long-EZ hints
Whenever BID tape is called out in the plans, this refers to a given width of BID cloth cut off the roll at 45 degrees to the selvage edge. This "tape" then works into a corner "variesily" as compared to 90 degree tape. Pre woven BID tape at 45 degrees is not available to purchase anywhere to our knowledge. It is ok to lap 1/2" where a long piece is required. Do not confuse these "tapes" with the spar cap material (3" wide unidirectional tape).

Long-EZ Fuel Tanks
CAUTION!! Be sure to align bulkhead's RB45 and RB23 parallel to the B.L. (fuselage CL), or your tank will not fit the wing.

When boring the 5/8" dia. holes in the centersection and wings, using the spotface tool, go slow!! Clear the spotface frequently and be sure not to get the layup too hot. Resharpen the tool if required.

Carving the inside of the fuselage bottom R45 PV foam can most easily be accomplished by using a very stiff wire brush, cup or cone shaped, in a drill and cut the foam away about 1/4" to 3/8" at a pass. Then

smooth it down with a high speed hand held disc sander (Metabo, Bosch, etc). Finish it with #40 grit sand paper in your fingers. Be careful not to gouge the foam in the corners with the edges of the sandpaper.

Carving the outside shape of the Long-EZ fuselage will be a lot easier if you rough the corners off with a large carpenters saw (careful not to cut too deep). Then use a body sander with a course sanding disk (or any highspeed power disc sander). Sand right into the bottom longeron till a max. of 0.4" of wood is visible. This gives you a rough shape. Now get a real coarse wood rasp (hardware store). This tool will remove foam with very little effort, and will enable you to arrive at a really pleasing shape. Finish with a 36 or 40 grit hard sanding block. This entire carving job can be done in 2 to 3 hours.

After carving the outside of the fuselage, just before laying up the outside skin, lay out the outline for the speed brake with a magic marker. Now stick strips of grey tape (furnace duck tape) in this area covering the entire speed brake area. Then proceed with the UND skin layup. When you cut out for the speed brake it will be much easier to separate the glass skin from the R45 PV foam. Unlike the urethane foam used for the VariEze fuselage, the R45 PV has tremendous peel strength retaining the glass skin.

BUILDER HINTS - VARIEZE ONLY
When laying up UND spar caps be sure to butt the cap material to the wing fitting and squeegee outboard. Do not trim the glass cap material at the fitting, "yaw" or slide the UND to butt to the wing fitting (keep fibers straight spanwise).

Addition to CP 24 page 11.
We omitted the W.L. and B.L. of the nylaflow tubes routing the pitch trim cable through the instrument panel. These should be at B.L. 9.5 (5/8" inboard of the left side) and top cable at W.L. 9.6", bottom cable at W.L. 8.3" (top of longeron in W.L. 23).

INSTALLATION OF LONG-EZ GEAR ON VARIEZE
Builder Report by Craig Gottschang.
Since the original VariEze main landing gear is no longer available, those of us building or retrofitting a VariEze must use the Long-EZ gear. Having just completed this installation on my Eze the following comments may be helpful to those building or retrofitting the Long-EZ gear:

The Long-EZ gear is both wider and fatter then the VariEze gear and consequently the aluminum extrusion attachments are spaced wider than the Eze. Rather than having two 1/8" extrusions sandwiching each gear attachment tab, two 1/4" extrusions are used on each fuselage side with a single 5/8" steel rod extending between them, upon which the gear tabs are mounted. The gear tabs themselves are beefed up considerably with BID layers locally on both sides while the wrap cloth is actually thinner using 18 layers of UND top and bottom.

The main gear comes from RAF with a 1/4" ridge all around, apparently from the molding process. This ridge must be sanded away flush and a power grinder is a necessity. In addition, 3" of each leg must be cut off for proper gear height on the Eze. The plans call for an 8 layer UND buildup, layered in crisscross fashion, to improve the torsional

strength of the main gear. I questioned the requirement for so much beefing up for use on the lighter VariEze but RAF informed me that the basic gear has little torsional strength in itself and must have the UND wrap whether used on the Long-EZ or the VariEze.

Having already installed the 1/8" extrusions on my Eze, my initial plan was to use them on the new gear. Unfortunately, they are too close together and would not allow a smooth "U" shape to the wrap around layers. I was concerned that this would cause an inherent weak spot in the attachment tabs. In addition, the old extrusions are not wide enough to accommodate the larger gear tabs. I found that the old extrusions could be removed easily by simply unbolting the popping them loose. It was not necessary to uncover the heads from the outside as they were held securely by micro. After removing the old extrusions I ground off most of the protruding bolts. The two forward most bolts on each side are common to the new extrusions and should be uncovered from the outside skin and removed. The new aft gear extrusion is aft of the old attachments, requiring the insert of some .7 x 1.0" wood pieces locally and then a BID buildup to support the new 1/4" extrusion.

Before installing the new extrusions, (retrofit only), determine which attachment holes may be drilled from the inside and go ahead and pre-drill these 1/4" holes in attach. Some of the holes may not be drilled from the inside due to seat back interference and are more easily located from the outside if not pre-drilled. When installing the attachments, bolt them together with the steel tube in between and position them in the airplane with clamps. Where able, drill the holes from the inside, temporarily bolt these, and then drill the rest from the outside. You may wish to remove the extrusions for final drilling through the aluminum. Once all holes are located and drilled, the extrusions are permanently installed with flox.

The actual mounting of the landing gear is easier than the old method and the plans are clear on this operation. The only change is to lengthen the aft gear tab (plywood jigging block) by .25". The tab needs to be longer than the Long-EZ due to the greater forward tilt of the main gear on the VariEze. The plans also call for a 5/8" diameter "spot facing tool" for use in construction of the gear tabs. This is a tool used frequently in the Long-EZ and sells for $29.95 from EZ distributors. Borrow one from a Long-EZ builder if you can.

The new gear installation requires an additional set of drawings from RAF at $7.50. The steel rods, with inserts are $9.90 each from Brock and 1/4" extrusions may also be available now. Other hardware is available from Wicks or Aircraft Spruce.

Although switching to the new gear initially seems like a lot of extra work, it is actually not that difficult and in fact easier than the old system. Above all, you end up with a landing gear that will withstand a crunch job landing now and then with complete confidence. From the looks of mine I think it could withstand a landing in a minefield! It is worth the effort. **SKETCH OF FORWARD EXTRUSION OMITTED**

LONG-EZ LYCOMING EXHAUST SYSTEM

The adjacent drawings show the system now being tested on N79RA. This system is very similar to the original one which we welded up ourselves, with the addition of a "ball" joint on each stack to take

care of vibration. It is working well so far, and looks like the way to go. This system is made and sold by Ken Brock, and can also be used on Lycoming powered VariEzes. Note: Lycoming flanges and tube sizes are shown. If you have a Continental engine, refer to Section IIA and build a similar exhaust system to exit the lower cowling just below the trailing edge at B.L. 19.5". A Continental version is not available from Ken Brock at this time.

(Drawings on page 7 and 8)

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas, FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LONG-EZ PLANS CHANGES

LPC #5, MEO, Page 5-1
Spacing between dimension on fuselage sides is 10", aft dimension is 3".

LPC #6, MEO, Page 20-2
Add A,B,C, dimensions: A = 102.15"
B = 108.35"

C = 118.35"

LPC #7, MEO, Back cover of plans.
Wing root leading edge should be 113.9", not 113.4"

LPC #8, MEO, Page 19-8 Step 9.
Second line should read "form the 0.7" rib by removing foam with a rotary file".

LPC #9, MEO, Page 19-6, Step 6.
Third line down LWA7 should be LWA2.

LPC #10, MEO, Page 19-6.
Lower right paragraph, LWA7 should be LWA2.

LPC #11, MEO, Page 19-7.
Bottom right, 3 lines up, LWA7 should be LWA2.

LPC #12, MEO, Page 19-8.
Bottom left, 2 lines up, LWA8 should be LWA7.

LPC #13, MEO, Page 20-1, Step 1.
Third line down, Add page A3 and A14.

LPC #14, MEO, Page 2-2.
Airframe bolts AN3-11 should be AN3-11A

LPC #15, MEO, Page 2-1 Tools.
Change "2 pcs 16 x 48" to "One piece 1/16" or 1/8" thick x 24" x 48"

LPC #16, MEO, Page 10-2.
Clarification: Remove the word "centerline" two places, W.L. 19.4 is correct, but is not centered on the shear web.

LPC #17, MEO, Page 4-2.
Bottom right: Clarification: "both sides" means "left and right, on the forward face only"! The foam doubler goes on aft face, with no additional plies at this time. See Section A-A, B-B and C-C on page A3.

LPC #18, MEO, Page 3-3.
Jig table size omitted - add 3 ft x 11 ft.

LPC #19, MEO, Page A4.
Engine mount extrusions "Chapter 6" should be "Chapter 14", 2 places.

LPC #20, MEO, Page A5.
Clarification: The 15 ply BID pad for the aft gear attach angle should stop at W.L. 12.35 (Don't glass above 12.35)(Chap 5).

LPC #21, MEO, Page 2-4 Metal.
"3 ft of 1.8 x 1" x 1" should be "3 ft of 1/8" x 1" x 1" aluminum angle"

LPC #22, MEO, Page A-3 correction.
Hole for gear retract drive tube should be 1" to the right of CL.

LPC #23, MEO, Page 13-6.
NG 31 is called out of R45 dark blue foam, should be R100 1/4" red foam, see page 2-3. Also note on page 2-3 that F28 can easily be cut in one piece from the instrument panel foam sheet.

LPC #24, MEO, Back Cover
Nose gear CL is a W.L. -22 not -23.

LPC #25, DES, Page 4-3 and Page 2-2.
Aluminum can be substituted for the steel firewall, don't install fiberfrax now. Wait until after cowling installation. This allows you to wrap the fuselage skin around onto plywood and allows you to layup the 1 ply inside lip on the cowl lip. You will then have to remove things bolted to the firewall to install the fiberfrax and aluminum. Install fiberfrax with silicone rubber, not epoxy.

LPC #26, OPT.
To save work and weight substitute UND for BID on centersection spar as shown on page 4 of this newsletter.

LPC #27, DES.
For rough or grass fields and to relieve stress on nosegear components, install the spring assembly (page 8) in place of the NG 9/10A rod.

LPC #28, MEO, Page 14-2, Step 4.
Outboard LWA 1 (sketch on left center of page) 1.0" dimension should be to outside of CS 5 and 8, not inside. Change inside dimension to 0.75". Be sure to transition edges of all metal parts with flox.

VARIEZE PLANS CHANGES

DES, Sect IIA, Page 7
Sect IIC
Revise fuel vent system per this newsletter page.

DES, Section I, Page 22-5
Move canopy safety catch to F.S. 57.

DES, Sect I, Page 9-3
Alum can be substituted for the steel firewall if fiberfrax is used. Don't install asbestos or fiberfrax now. Wait until after cowling installation. This allows you to wrap the fuselage skin around onto plywood and allows you to layup the 1 ply inside lip on the cowl lip. You will then have to remove things bolted to the firewall to install the fiberfrax and alum. Install fiberfrax with silicone rubber, not epoxy.

LONG-EZ SPAR-CAP THICKNESS - CENTERSECTION SPAR AND WING
The number of plies of the UND tapes for the spar caps shown in the plans (Chapter 14 and 19) is based on each ply being .035 to .038 thick. We have found that some of the UND tape is of less bulk than expected, and is laying up only about .025 per ply. If this happens, the spar is weak and the depressions are not filled flush. Check your spar cap material by making a 5-ply layup. Cure then measure thickness. It should be 0.18 thick. If it is only 0.125 thick you must add the following plies to all your spar cap layups. All the additions can go on top of the plans shown caps.

Chapter 14, Step 7, Bottom Cap.
Add 1 Ply full span, plus 1 ply to B.L. +-45, plus 1 ply to B.L. +-30, plus 1 ply to B.L. +- 15.

Chapter 14, Step 7, Top Cap.
Add 1 ply full span, plus 1 ply to B.L. +-47, plus 1 ply to B.L. +-37, plus 1 ply to B.L. +-27, plus 1 ply to B.L. +-17, plus 1 ply to B.L. +-12.

Chapter 19, Step 5, Bottom Cap.
Add 1 ply B.L. 25 to B.L. 130, plus 1 ply B.L. 40 to B.L. 90.

Chapter 19, Step 7, Top Cap.
Add 1 ply B.L. 23 to B.L. 140, plus 1 ply B.L. 33 to B.L. 92, plus 1 ply B.L. 40 to B.L. 78.

CAUTION! - Use care in carving spar cap troughs, (Chapter 14, Step 5). Do not carve too deep!

DRAWINGS OF LONG-EZ/VARIEZE LYCOMING EXHAUST OMITTED

DRAWINGS OF LONG-EZ SHOCK STRUT OMITTED

ITEMS FOR SALE AT RAF - Pick up or Ship.

Long-EZ (VariEze) Main Gear	$277.95
Long-EZ (VariEze) Nose Gear	49.75
VariViggen Fiberglass Parts:	
VV Cowl - left or right half	$129.50
VV Nose Bowl	92.00
VV Tank Cover	63.00
VV Visor	68.00
VV Landing Light Dome F25	9.50

Canopies, Shipped FOB Dayton or Picked up at RAF
Long-EZ or VariEze Canopies.

Clear	$199.00
Green	229.00
Smoke	249.00
Bronze	249.00

Add 6% for California orders. Add $20.00 for overseas main gear orders. Main gear are shipped by Greyhound - please include telephone number with order. Main and nose gears and canopies are generally in stock for pickup at Mojave. Call ahead for availability of VariViggen parts.

BITS AND PIECES
Cutaway Prints of VariEze, printed on 80 lb paper, rolled in stout mailing tube $9.95 each or 3 $25.00. Suitable for framing. Also available folded in a 8 1/2" x 12" clasp envelope for $7.50.

Contact: Robert V. Coon
26 Cloverdale Str,
Pittsfield, Mass 01210

Second Annual EAA Rocky Mountain Regional Fly-In
September 6 and 7, 1980
Overnight T-hangars - camping permitted.
Pancake breakfast both days.
Contest, displays, and trophies both days.
Ft Collins - Leveland Airport (Cheyenne Sectional)

Contact: Bill Marcy
3041 S. Golden Way
Denver, CO 80227
(303)986-4398

This is a Chapter 7 Fly-In and invite all EZE Drivers (along with Long-EZ, if possible) to attend. We hope to have "A GOOD ONE".

FOR SALE
C-85 Tapered Crankshaft, ground .010" under. Contact Richard Nelson (805) 544-5797.

CAN I BUILD A COMPOSITE AIRPLANE? WILL I ENJOY WORKING WITH GLASS & FOAM? IS MY WORKMANSHIP ADEQUATE TO BUILD AN AIRPLANE? WHAT ARE THE TECHNIQUES USED IN VARIEZE & QUICKIE CONSTRUCTION?

There is now available an introductory kit to answer these questions for you. The kit consists of a book and sample materials, or the book can be purchased separately. The book, "Moldless Composite Sandwich Homebuilt Aircraft Construction" consists of 26, 11x17 pages (equal to 52 pages) describing how the material is applied, education on the materials, tools required, inspection and repair methods. Sample materials include: foam (2 types), fiberglass (2 types), epoxy, microspheres, flox, peel ply, wire for hotwire saw, etc.

The book is $14.50, and is available from Aircraft Spruce, Wicks Aircraft Supply, and Rutan Aircraft. (Add state tax, if resident).

The kit (book and materials) is $45.00, plus postage, and is available from Aircraft Spruce and Wicks, not from Rutan Aircraft. (Add state tax, if resident).

Aircraft Spruce & Specialty
201 W. Truslow, Box 424
Fullerton, CA 92632

Wicks Aircraft Supply
410 Pine
Highland, IL 62249

Rutan Aircraft Factory
Airport #13
Mojave, CA 93501

LIST OF EZ'S THAT HAVE FLOWN
RAF maintains a list of completed EZ's so we can contact you direct in the event of a flight-safety related problem requiring an emergency directive. This list is also beneficial to access statistical items

relating to structural and system reliability. The list is, of course, kept in confidence. A print out of registration numbers is shown below. We believe there are about 100 flying VariEzes that are not on our current list. If you have an EZ flying please scan this list to find your number. If you are on the list please write RAF and tell us the date of first flight and the current total flight hours. If you are not on the list please write and supply: 1. Type (Long-EZ, VariEze, VariViggen).

2. Name of Owner.
3. Address.
4. Date of first flight.
5. Registration number (N-number).
6. Total hours.

1 N9283A	39 N?	77 N27CP	115 N3VE	153 N1WX	191 N245EX
2 N78LM	40 N?	78 N281	116 N67EZ	154 N60HD	192 N11SK
3 N83DL	41 N79PJ	79 N101EZ	117 N770DY	155 N2286A	193 N99VE
4 N65B	42 N?	80 N?	118 N50RW	156 N886	194 N11SQ
5 N1WX	43 N57EZ	81 N6EZ	119 N837	157 N859	195 N55VE
6 N999EZ	44 N2280	82 N81JC	120 N295EZ	158 N46EZ	196 N24RW
7 N51975	45 N88886	83 N34VE	121 N76WJ	159 N877EZ	197 N2CR
8 N78EZ	46 N2TV	84 N?	122 N39EZ	160 N51935	198 N37517
9 N747U	47 N27RG	85 N45846	123 N34MB	161 N21LB	199 N45790
10 N9HR	48 N575JW	86 N752EZ	124 N422	162 N2UM	200 N681JB
11 N?	49 N22809	87 N28JF	125 N66EZ	163 N25RH	201 N?
12 N4CM	50 N6459	88 N13CG	126 N?	164 N13EZ	202 N13MW
13 N7WC	51 N378	89 N?	127 N27CP	165 N60EZ	203 N80JG
14 N91CL	52 CGVEZ	90 N17EZ	128 N234EZ	166 N9608A	204 N10ZM
15 N168BG	53 N78PD	91 N240EZ	129 N?	167 N78JK	205 N?
16 N7EJ	54 N899EZ	92 N21DN	130 N14533	168 N322EZ	206 N?
17 N747TC	55 N78248	93 N375	131 N18VL	169 VHEZK	207 N?
18 N65H	56 N36EZ	94 N3784D	132 N?	170 N9RC	208 N305Q
19 N5021Y	57 N711QB	95 N115AM	133 N17DR	171 N500EZ	209 N77NS
20 N22802	58 N35EZ	96 N98CG	134 N5WZ	172 N115EZ	210 HB-YBG
21 N78SP	59 N4WH	97 N95F	135 N41GL	173 N51820	
22 N2NP	60 N15LL	98 N25LP	136 N808CM	174 N139EZ	
23 N?	61 N216EZ	99 N33ST	137 N?	175 N222SK	
24 N90331	62 N124G	100 N45884	138 N26EP	176 N37EZ	
25 N224D	63 N9783A	101 N?	139 VHDED	177 N?	
26 N68M	64 N300EZ	102 N29CE	140 N27EZ	178 N98EZ	
27 N51WC	65 N37913	103 N64CB	141 N3KJ	179 N?	
28 N27CH	66 N84SY	104 N477CM	142 N90395J	180 N2VE	
29 N301RW	67 N?	105 N20VE	143 N?	181 N36SD	
30 N179BB	68 N9113A	106 N9036G	144 N7EZ	182 N999JW	
31 N36RJ	69 N13CF	107 N34RD	145 N4EZ	183 N70VE	
32 N3AX	70 N95BC	108 N12CN	146 N23FF	184 VHIWS	
33 N95DB	71 N253EH	109 N48EZ	147 GLASS	185 N103B	
34 N344SP	72 N7ER	110 N77EJ	148 N5EP	186 N44EZ	
35 N10	73 N123EZ	111 N4985Z	149 N56EZ	187 N22803	
36 N46JT	74 N34RD	112 N808CM	150 N8037T	188 F-PYHZ	
37 DEEEZ	75 N9783A	113 N77LF	151 N50EP	189 N77TJ	
38 CGMEZ	76 N9783A	114 N666EZ	152 N?	190 N40EZ	

Ray and Nova Cullen have moved.
New address is now: Rt 1, Box 213 #26
Baker, OR 97814
(503)523-5096

They are now offering plans for their survival kit plus the custom VariEze/Long-EZ seats for $8.00. They will also supply some of the more difficult to locate items of the survival kit. They are still interested in supplying any builder support that is requested even though they are now in a very rural area.

The canopy seal they are using on the side rails of the canopy is a 3M Adhesive Weather strip part #021200-01235 Cat #1235, Stock #93011. It is sold in a few stores there in Oregon but is still hard to find. Nova and Ray have tried almost everything on 22809 to gain rain protection and this stuff is the best! Note: Ray and Nova keep their airplane out a lot in a very wet climate.

VARIVIGGEN NEWS - By Mike Melvill

Here it is almost time to pack the Viggen and head for Oshkosh, where has the year gone? Hopefully this year we will have another Viggen to look at on the flight line. James Saunders of Miami, Florida, has got his Viggen N17VV, flying once again, and reports that he is very happy with his ship and has over 35 hours on it now with no problems. James' Viggen has the SP wings and a very pretty rainbow paint scheme. He also has a very complete, full IFR panel. The only change Jim recommends is to lengthen the nose gear strut by 1 1/2". He reports that this has substantially shortened his take-off roll. I have not tried this myself, so can not recommend a good way to do this. I will endeavor to obtain this information from Jim for the next CP.

N27MS has been to several airshows lately and now has 421 hours and 530 landings. The latest alternator is performing flawlessly (touch wood!!). My fuel gauge and oil pressure gauge (both Westach) are becoming erratic. I plan on replacing both with a new type that Aircraft Spruce is now stocking. Made by Rochester Gauge Co., they are bona fide aircraft instruments and look excellent. I will report on their performance in a future CP.

We have not heard from too many Viggen builders since CP24, but Bill Campbell is working on composite main wings, the rest of the aircraft is ready to paint. Gene de Reulle reports good progress on his Viggen, and sends the following builder hints:

"During the construction of every aircraft, there is a job that the builder dreads. On my Viggen I was particularly dreading the job of grooving the .2 x .3 capstrips for the ribs in the inboard wing. I realize that most builders do this by adjusting the blade height on their table saw but my table saw is old and not that accurate. Besides that, running a strip that small on a table saw is asking for short fingers if one makes a small slip. I think by accident I discovered a better way and I'd like to pass it on to other Viggen builders that may be coming to that stage.

I cut the .3 inch thick spruce (A/C Spruce Viggen kit) into .2 inch strips. Then taking my Dremel tool and Dremel router attachment with the smallest router bit they make, (I forget the number, but in the display case its the smallest) and clamping the spruce to a flat

surface and adjusting the router guide, I made a square notch the length of the strip.

The groove is so exact that its a beautiful fit on the 1/8" ribs. In fact, even on a curved surface, the capstrip can be held in place for glueing with only masking tape.

Starting at 9:00 am, I was able to cut; groove; fit; and glue all the capstrips for the top of the entire inboard wing by 1:00 pm. Now I will have to find something else to dread".

Arthur Schwartz came to Mojave for a check out in the Viggen in May, his report follows:

"I was beginning to see the light at the end of the wind tunnel and felt that I could best help myself with check ride in a Viggen before testing my own craft which should be ready in early August. I contacted Mike Melvill and arranged to arrive at Mojave airport in the afternoon of May 2nd. Finding the Rutan hangar made for no difficulty. Introduced myself to Sally and soon met Mike. Both, immediately gave me the feeling that I was an expected guest with most comfortable feelings. Within another few minutes I was looking at 27MS and filled with admiration and envy. I just don't think there's a higher compliment to be expressed. Before I could say or think much more I was seated in the rear seat, buckled-in, wearing a head-set and talking with Mike with a reliable intercom. For this trip I was going to follow Mike through. Mike invited me to taxi and I was quickly impressed about the ease of S turns with gentle pressure on the toe brakes. Mike encouraged me to go a bit faster and at about 20-25 mph, I'd judge, the air-rudders were quite effective. The large vertical fins do their job well. There was a very solid and substantial sensation to the taxi. At the end of the runway Mike went through the check-list and set the reflex at 8 degrees. The elevation at Mojave is about 2,900 feet plus an OAT of 85 degrees giving us a density altitude of about 5,000 ft. So, I was expecting a rather long ride down the runway. Mike advanced the throttle and we were rolling. I was likewise on the throttle and stick but without any input. I was just getting the "feel" of things. Mike suggested that I watch the canard as a reference point and get the sense when it starts to fly. It seemed to me that it doesn't begin to fly gradually as we're more accustomed, but sharply. One moment it is not flying and the next it is. We were climbing about 750-800 feet per minute and Mike was reducing the degrees of reflex to about 4 degrees. The vibration was smooth, the noise well behind us and with headsets things were really quiet. The rear cockpit has adequate instruments for flying, i.e. airspeed, tachometer, compass, and information about gear position. When we got to about 5,000" msl Mike made some stalls but, of course, only the canard. It was ever so gentle. Then he asked me to try my hand at flying. At this very moment, I knew that I had a very different airplane. Sensitivity with a gentleness. This might be thought of as a contradiction in terms, however I think not. I was immediately impressed with the high rate of roll and this was at speeds of about 140 mph. So, I'd say that a low time pilot might have a tendency to over control. But, this high rate of roll becomes at low speeds the ease of handling and touching-down exactly where the heart desires. The commercially built airplane that came to mind was the Mooney where the ailerons are also quite effective. Since the

afternoon was well upon us and the air was somewhat bumpy Mike suggested landing and to start early the next morning. I felt that the motion in turbulence was not all that unpleasant and I could have easily spent more time. I was just so impressed with the responsiveness of Viggen that I was not too bothered by anything short of something really major taking place. Came in downwind, throttle back, at some speed below 120 mph let the gear down, set reflex at 4 degrees. When we were at cruise the reflex was all the way aft or 0 degrees. At Mike's instruction I set up an attitude that gave me a speed of about 75 mph. Held the airspeed but having no sensation of a nose high condition. To stay lined up with the runway presented no difficulty. Wind was light. From the rear seat I began to have a problem sensing the height above the runway and took instruction from Mike in the front seat. At the moment, just before a touchdown the slightest bit of flare, just a little. The mains were down and directional control was easily maintained with air-rudders. At this time Mike reminded me of how the canard will stop flying. The very same way it starts - - - suddenly, and I should try to hold it off so the nose gear doesn't hit hard. I had a couple of good ones and a couple of not so good.

The next morning things were different. It was cool, quiet and I was sitting in the front seat. After the day before I was starting to feel like this airplane and I were made for one another. What else gave me that feeling was Mike Melvill as an instructor, he was there but also wasn't. He really permits you to be in charge and learn from what you do right and from what you do incorrectly. Today we were going to do the things that you must do before you take the airplane high in the air away from the runway and the earth. It's the thing that most pilots never do and it's controlling an airplane in that state between flying and not flying. We were to lift the nose wheel off while going down the runway and test pitch authority and aileron control (rocking the wings while riding on the mains). After going through the check-list I placed myself on the center line and know that I have about 10,000 feet of runway ahead. Applied power and got moving to about 50-55 mph, came back on the stick until the nose wheel lifted off and at the same time reducing the power ever so slightly. In this condition you can move the stick forward and back and watch the nose rise and fall demonstrating the pitch authority. The lateral movement of the stick (gingerly) will rock the wings. I did that up and down the runway for a considerable time. It builds confidence in feeling about handling, and the responsiveness of the Viggen is tested. Next Mike suggested I try a lift-off of nose and mains but to stay in ground effect. Reflex at 4 degrees, more power than for just nose wheel lift-off, until moving close to 60 mph plus, a lift off, test the pitch control and lateral movements of the wings and then ever so gradually reduce power. Especially not to be concerned that all the runway is gone and make the sad error in a pusher by chopping the power. If there's one place where pilots who don't have pusher experience, is being surprised when the nose-up attitude develops with reduced power, (abrupt reduction of power). But, generally in an airplane all changes should be done slowly and with gentleness. From this point it was into the air with making landings and take-offs. While I came to this experience with 400 hours, in my homebuilt Volmer Amphibian (pusher configuration) I regard and strongly urge anyone thinking about testing flying his newly built Viggen to visit with Mike and reward yourself with this most valuable experience.

A curious state of affairs develops between builder and airplane over the years of construction. The builder comes to regard the plane as a kind of extension of himself and endows the plane with some human features. Especially the one that the plane will take care of you, albeit without you having to do the flying. The reality is quite different you must be prepared to fly, the plane can't. There is a kind of old wives tale that goes through aviation circles to the effect that the builder should not test fly his own airplane. As far as I know the dynamics behind this remark has never been expressed and so I've taken this liberty to give a small insight into the relationship between builder and his creation."

This summer/fall will surely see a couple of new Viggens flying, Arthur Schwartz, Ken Guskott, Frank Stites all report being very close. See you at Oshkosh.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Where does it all go? Burt and Dick inspecting the various baggage and nose baggage areas in the Grand Champion "Pegasus" VariEze. Norm Ross and friend Glenne Campbell stopped by RAF recently on one of their many trips. Norm has flown the Grand Champ more than 300 hours since Oshkosh '79! During their stay Norm flew the Long-EZ and Mike, Dick and Burt flew Pegasus. We can now say first hand that this airplane performs and handles excellently. Even though it is well equipped, it is one of the lightest EZ's flying. Norm has the empty weight down to less than 600 lb. now, with alternator removed. Norm is the recognized expert in weight control. He fabricated intercylinder baffles by wetting out 1 ply BID with silicone rubber, then (after cure) mounting them with silicone - presto - a fatigue free baffle that is lighter than aluminum. Norm's CHT runs less than 350 degrees F on the O-200. It can be done, with good baffle workmanship.

This photo shows the extensive baffling on Steve Woods' O-200. An article on Steve's work will appear soon in Sport Aviation magazine. Also shown is the tufts on Steve's boat tail (photo by Steve from the back seat of the Long-EZ). The amount of turbulence is similar to the standard cowl. Whetted area is greater. The inlet itself is lower drag than standard.

New Brock exhaust installed on Long-EZ.

Burt----
I epoxied the polyurethane together and carved the fuselage as per your VariEze plans. Either your instructions were too vague or I misconscrewed them. The enclosed photo shows me carving away at FS42 just before I discovered my error. Can you offer a fix or should I fly it this way? You may answer in your newsletter because it might help others who have had this problem.

Jud Hansen
2674 No 97 St.
Omaha, NE 68134

Initial cowls out of the new metal tooling for VariEze and Long-EZ.

TESTS PROVE OLD FIBERGLASS AS GOOD AS NEW
Fiberglass composites were introduced 40 years ago, but only now have their service aging properties been tested. And the results are a revelation.

Real-life tests on fiberglass samples were carried out by two scientists at the Grumman Aerospace Corp., George Lubin and Peter Donohue. With a bit of scientific detection work, they tracked down fiberglass components from 11 to 19 years old that had flown on Grumman aircraft and that had been extensively tested prior to being put into service.

Before this effort, the only published data on aging of fiberglass composites were those based on accelerated testing performed in the laboratory, which is the standard tool in use for testing both fiberglass and other composites for in-service structural degradation.

According to Lubin, "hard work, luck, and the fact that Grumman wasn't quick to change fiberglass formulation" played a part in the unique opportunity to be the first to document actual before-and-after results on fiberglass components.

In their paper, "Real Life Aging Properties of Composites" --- selected best in its class at the 35th annual conference, Reinforced Plastics/Composites Institute, Society for the Plastics Industry--- presented last month, Lubin and Donohue detail the testing results on fiberglass components that flew aboard Grumman aircraft and were subject to extremes of climatic conditions and to combat. Without exception, all components tested showed virtually no degradation as long as they were properly protected by paint coatings.

Their conclusions dispel the myth that fiberglass degrades with age. More significantly, they throw into doubt the validity of accelerated laboratory aging, which invariably causes considerable degradation of samples tested---a result not supported by Lubin and Donohue's findings.

A reassessment of the criteria currently used for testing fiberglass composites is needed, the two scientists believe. They feel it is certain that current specifications based on such testing result in overdesigned and, therefore, overweight fiberglass structures. More realistic accelerated aging specifications would, they say, result in structures of fiberglass composites being lighter in weight. For aircraft, especially, this would permit significant savings.

The two also tested graphite composites, but owing to their relatively recent arrival on the composites scene, the results for these materials were not as conclusive as those for fiberglass.

ANCIENT AIRCRAFT PARTS PROVE DURABILITY OF FRP

Fiberglass composites don't degrade with age, provided they are protected by paint coatings, tests of 11 to 19 year-old aircraft components show. The tests also throw into doubt the validity of accelerated laboratory aging.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Boat-tail tested on VariEze N4EZ - Also installed is the new Great American Prop.

The RAF crew with the Long prototype. Left to right: Pat Storch, Burt Rutan, Dick Rutan, Sally and Mike Melvill, and Roger Houghton.

The Long-EZ prototype on grass. 500 x 5 tires are mounted, as well as the spring strut. The ride and handling is similar to most light-planes - very pleasant.

It seems the fastest Long-EZ builders are those that have built VariEzes. The adjacent fuselage is the first 1 1/2 weeks work by Herb Sanders. Other EZ-types of note are Ed Hamlin and Don Shupe. Ed and Don have a total of just under 1000 hours on their EZ's. Ed, Joanne, Don and Bernadette plan a round-the-world trip for a summer vacation when they get their Longs finished.

Pat and Sally after Pat's Long-EZ solo.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Mike and Dick at work on their Longs. Note tools for fuselage bottom carving and main gear attach hardware. The AN4-16A bolts require two washers for mounting these brackets. A shorter bolt should not be used, as it results in threads in the bracket.

25 EZ's, a VariViggen and a Defiant at Mojave! All the people are inside having lunch.

Sally with RAF's Long-EZ. She soloed N79RA last year. Sally and Mike are now working about 30 hours per week building their own Long. They plan to fly the new one to the Bahamas this Christmas for the Hospitality Club Fly-in.

LONG-EZ

FAST - EFFICIENT - HIGH UTILITY - LONG RANGE

Long-EZ N79RA with 75 gal. back seat tank during the world distance record flight. **PHOTO OMITTED

THE AIRPLANE
The Long-EZ is a small, high-performance, high-utility homebuilt sportplane. While recommended mainly for Day-VFR operation, competent

pilots can also equip it for night and IFR flying. Power plant is either the 0-235 Lycoming or the 0-200 Continental. It has an alternator-powered electrical system and can be equipped with electric engine starter. It's cockpit layout is designed to compliment pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wing strakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 P.V. core foam. (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal or wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

TRAVELLING MACHINE

At last, an airplane that is specifically developed for efficient, high speed, long-range travelling with room for two adults and plenty of baggage. Fuel allowance with two adults is 38 gallons. Single-place, you can carry 52 gallons! If you're in a hurry, you can cruise at 75% power at 8000 ft at 185 mph (161kts), burning 6.51 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles), in 5.2 hours with a 40 minute fuel reserve. If you're not in a hurry, you can cruise "economy" at 12000 feet at 144 mph (125 kts), burning only 3.52 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 10 hours with a 40-minute fuel reserve. Single place, using the entire 52-gallon fuel capacity, stretches the maximum range and endurance to over 2000 miles and 16 hours!

The high efficiency, long-range capability increases a pilots options for fuel availability and weather detours. The fact that the Long-EZ can carry the same load and fly as fast as other 160-180 horsepower aircraft, means large fuel savings - 29 mpg at fast cruise, 41 mpg at economy cruise.

UNUSUAL EFFICIENCY

The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a worlds distance record, and landing with enough fuel to surpass 5000 miles. At that, it's capability was not taxed - it's initial climb rate was over 600 ft/mn! At light weight, it climbed to 27000 ft in still air - an altitude unheard of for a fixed-pitch, non-turbocharged airplane. Our Long-EZ is so efficient, the engine can be

shut down while at 5-ft altitude over the numbers at only 120 knots, then it can pull up, fly at 360 degrees pattern and land on the same runway - completely without power! It's power-off glide angle is only 3.7 degrees - thus a belly-mounted drag devise (landing brake) is used for landings.

SUPERB FLYING QUALITIES
Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and safe stall characteristics. It can be maneuvered sharply, even to full aft stick, without fear of stall or spin. Flight tests show the prototype to be free from stall departures and spins for all types of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed.

Trim changes due to power, gear retraction or landing brake are all very small. It's wide cg range allows a large range of pilots or passengers weighing up to 240 lbs.

The Long-EZ's approach and landing speeds are 75 mph (65 kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.

THE HOMEBUILDER SUPPORT
The Homebuilder support. The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

THE TEST PROGRAM
The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

COST AND BUILDING TIME
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, VFR instruments, plumbing, tools, tires, wheels, brakes and upholstery (cushions and special suitcases) costs about $2,900. Any of these items can be purchased separately. We strongly recommend that you get the distributor's catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

The S-glass roving molded structural fiberglass main gear and nose gear are available from RAF, at $277.95 and $49.75 respectively. Many other prefab parts ranging from propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased

from the listed manufactures. All those prefab parts cost approximately $1,600 - and using them, the competent builder can build a Long-EZ in as little as 800 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above cost of the prefab items. Contact the manufactures for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

Engine costs vary widely. Our prototype has an 0-235 Lycoming that had 1400 hours, when purchased for $1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from $3000 to $6000. Engine accessories, such as instruments, prop extensions etc cost about $300 to $500. In summary then, total cost can run from $5300 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $9900 for everything available purchased and a zero-time engine. IFR avionics can add from $2000 to $15,000 to those numbers, with many options available.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.
Empty Basic	710 lb.
Empty Equipped	750 lb.
Solo Weight	960 lb
Gross Weight	1325 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	550/830 ft
Climb (solo/gross)	1750/1350 fpm
Cruise 75% 8000 ft	183 mph
Cruise 40% 12000 ft	144 mph
Max range * 75% (solo/2 place)	1370/965 mi
Max range * 40% (solo/2 place)	2010/1430 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200
SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIA Continental	19.00	21.00
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order. Newsletter not taxable.		
TOTAL		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $3

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $2

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $2

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.

BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Sally Melvill taxiing out for first Long-EZ solo flight.

Long-EZ parked nose-down with two VariEzes.

The nose gear retracts for parking and in flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

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Burt, Pat, Mike, Sally, Dick and Jeanna out practicing formation flying. Don't miss this 3-ship airshow at Oshkosh this year! Photo by Jim Sugar shot out of a Grumman Tiger baggage door.

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THE CANARD PUSHER NO 26 Oct 80

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 26. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 26. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 26. If you are building a VariEze from 2nd Edition plans you must have newsletter 16 through 26. If you are building a Long-EZ from 1st Edition plans you must have newsletter 24 through 26.

A Current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave CA., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

Saturday Demos - Every Saturday (except as shown below) RAF conducts a demo at our shop at the Mojave Airport.

We start the presentation/discussion at 10 am each Saturday with flight demos of our experimental aircraft at approximately noon (weather permitting). This will be done each Saturday except on the date listed below.

27 December 1980 Christmas weekend.

We will be closed from the 25th to the 28th December and also the 1st and 2nd January 1981.

Bring any of your parts for inspection. We are located near the west end of the flight line at the Mojave Airport about 2 hours drive north of Los Angeles on Highway 14. When arriving at Mojave by car turn east at the Carls Jr restaurant to find the airport.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to

keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed your reply.

ITEMS FOR SALE AT RAF

Long-EZ/VariEze Main Gear	$277.95
Long-EZ/VariEze Nose Strut	49.75

VariViggen Fiberglass Parts:

VV Cowl - left or right half	$129.50
VV Nose Bowl	92.00
VV Tank Cover	63.00
VV Visor	68.00
VV Landing Light Dome F25	9.50

Long-EZ or VariEze canopies

Clear	$199.00
Green	229.00
Smoke	249.00
Bronze	249.00

Add 6% for California orders. Add $20.00 for overseas main gear and canopy orders. Main gear are shipped by Greyhound - freight collect. Please include telephone number with gear orders. We would like to have at least two weeks advance notice if you intend to come by and pick up either main gear, nose strut or canopies. Canopies are for pick up only at RAF, otherwise shipped FOB from Dayton, Ohio. Canopies - overseas orders---Freight on a canopy can be as high as $400, so if at all possible try to get with other builders to double up when ordering. Two or three can go for the same freight.

The Prototype Long-EZ prefabricated Fuel/Baggage Strakes
These will be installed on Mike's Long-EZ, to check the fit and develop installation drawings. These items should be available this winter. Bear in mind that these are large pieces and therefore are likely to be quite expensive. We will report on difficulty of installation and on building time saved in a report in the next newsletter.

NEW BROCK ITEMS
Ken Brock Manufacturing now stocks a new stick grip that fits VariEzes and Long-EZs. It is styled after the ski pole grip that nests the lower side of your palm, resulting in a comfortable, low-fatigue grip. Part no. LESG1. Ken also has in stock, the new square style 12 volt fuel pump. This pump can be substituted for the Bendix electric pump with a small weight savings and at less than half the cost. Part no. is EFB. We have recently finalized the engine mount design for the Lycoming dynafocal configuration. By the time you read this, Brock will have this item available.

Section IIC Lycoming Installation.
When we ran out of this section this fall, we decided to prepare a new edition, incorporating modifications and improvements for the Long-EZ. We have held up final layout and editing on this until Mike completes his Long-EZ dynafocal engine installation. Thus, the new edition will be thoroughly checked for accuracy, but will not be available until at least mid November. If you absolutely need one before that we can

xerox you a copy of the old edition, but we strongly recommend you wait for the latest.

THANKSGIVING SEMINAR - 29th November 1980
Rutan Aircraft and Quickie Aircraft Corp. will hold a joint workshop at Quickie Aircraft in Hangar 68 on Mojave Airport. Flight demonstrations of the Long-EZ, VariEze, VariViggen, Quickie and Q2 will be held between 10 am and 11 am. Lunch will be from 11 am to 12 noon. The workshop will be from 12 to 5 pm. There will be no catered lunch as such, but the airport cafe has been alerted and will have sandwiches available. We will have chairs, but it is possible that we may have more people than seats, so if at all possible, bring your own chair!

The seminar will cover methods of construction on Long-EZ, VariEze and Quickie aircraft. Anyone with parts they would like inspected, bring them along.

Due to an expected large crowd and in order to better prepare the airport cafe, please write and let us know if you intend coming, and the number of people in your party.

OSHKOSH 80
Sixty two VariEzes, both Long-EZs, a VariViggen and a Defiant at one flyin? The only place this can happen is Oshkosh. For the second year running, a VariEze won the Grand Champion Homebuilt Trophy. This year it was Fred Keller of Anchorage, Alaska. This is the third year he has flown his EZ to Oshkosh, round trip mileage 7000 miles! For a complete write up on Fred's airplane and on the Oshkosh convention, refer to the articles by Jack Cox in the October 1980 Sport Aviation magazine.

To help Fred celebrate, Burt and Pat flew the Defiant to Alaska after the Oshkosh show. We really enjoyed the Alaskan hospitality, and the beautiful scenery. Special thanks to Randy Doll, Norm Ross, Glenne Campbell, Peter Gerdtson, Fred and Sharon Keller and George and Ruby Pappas, for showing us what it is like to fly amphibians and floatplanes and how the bush pilots operate. Within the next year we may plan a Nome, Alaska to Puerto Rico non-stop distance record in a Long-EZ.

Our return trip was down the west coast, 13 flying hours from Anchorage to Mojave with an enjoyable overnight stay in Ketchikan, Alaska. The beautiful 17000 ft Mt. Logan with it's glaciers reaching to the sea is a sight we will not soon forget.

OSHKOSH 500 - The LBF Race
This years' race was well attended with the following entries:

- Four Formula-one Racers
- Two Long-EZ's
- Six VariEze's
- One Adventure
- One RV4
- One KR1
- One KR2
- One BD4

Two Mustang II's

This year, for the first time there was a separate $1500 prize for the best placing VariEze/Long-EZ. The following put up the money to sponsor the EZ class:

Aircraft Spruce and Specialty
Wicks Aircraft Supply
Ken Brock Manufacturing
Applied Plastics
Herb Sanders
Rutan Aircraft Factory

Steve Wood's VariEze N56EZ won the EZ class money plus $500 for placing third overall. Nat puffer won $200 for placing 5th overall. Refer to the October 1980 issue of Sport Aviation for detailed results. The LBF race is a good format for a comparison of airframe and engine efficiency. When reading the results, use care to note which airplanes flew two place since they are handicapped differently. To qualify for the VariEze prizes the VariEze must fly single place.

In order to compare efficiencies, we have taken the VariEze results and plotted miles per hour vs. miles per gallon. On this plot we have drawn a sea level theoretical curve assuming 0.5 specific fuel consumption, 1.4 sq. ft. f, 22 ft span, 0.9 span efficiency and 1050 lb gross weight. The data show that Nat Puffer's airframe/engine combination was the most efficient, having a very slight edge over Steve Woods. If Nat had opened her up and flown the race faster he probably would have beat Steve in fuel-corrected speed. Many had expected the watercooled Rotorway to be more fuel efficient than the aircooled engines. Race results show otherwise. It ran 8 mph slower than Woods, while burning 19% more fuel - both were running peak EGT mixtures. The reader is cautioned to not assume that all the differences are engine related, since there are often relatively large differences in airframes and pilot technique.

Only four of the two-place entries finished the race. Their relative efficiencies are shown in the second plot. The RAF Long-EZ ran at essentially the same efficiency as Kent Pacers exceptional Mustang II. Johnny Murphy's Long-EZ ran poorly mainly since he had to use rich mixture to prevent overtemping the oil (he has since solved his cooling problem).

GRAPHS OF OSHKOSH 500 RACE RESULTS OMITTED

LARGER ENGINES FOR LONG-EZ?
A number of builders have asked if it is feasible to install the 160hp Lycoming O-320 engine in a Long-EZ. At this time we must respond that this installation is definitely not approved. In order to approve this we would have to do a new structural analysis and possible beef up of a large portion of the airframe, install the engine, then conduct new tests to confirm structural adequacy and to develop the cooling, induction, vibration, exhaust, propeller matching, expansion of aerodynamic envelope, etc. Unless these tests and development are done it would not be known if it were feasible, much less recommended.

A larger engine will make the airplane tail heavy and lower the useful load. Higher horsepower would result in a small increase in speed and

a large increase in climb. However, the Long-EZ's ceiling of over 19000 ft at gross and demonstrated 27000 ft at light weights, makes it the last light plane that needs better climb! Lycoming engines have their best fuel efficiency at about 70% power. If an O-320 were throttled down to 51% power, to cruise at the same cruise speed as the O-235, it would burn more fuel than the O-235. The calculated comparison below shows that the O-320 saves only 18 minutes on a 500-nm trip, but costs $9.11 more in fuel. This is over $30 cost per hour of saved trip time.

	115hp O-235	160hp O-320
75% power cruise	161 kt	179 kt
75% power fuel flow	6.7 gph	9.32 gph
Nautical mi/gal @75%	24	19.2
Nautical mi/gal @127kt	37.3	36
Range @ 75% power (45 min reserve)	1150 nm	920 nm
Flight time-500nm trip	3 hr 6min	2 hr 48 min
Fuel cost-500nm trip	$36.46	$45.57

LONG-EZ HIGH DENSITY FOAM SUBSTITUTES

Due to excessive cost increases, the dark red, 0.2" R250 PV core foam is no longer being used in Long-EZ kits. For a while this summer and fall, 3/16" thick plywood was supplied in its place, We have recently approved a high density urethane/polyester foam (white in color, 18lb/cubic ft density) for this use also. If you receive the white foam it will be in four pieces, 12" x 48" 0.2" thick. This requires a micro joint for the instrument panel and F22. This joint need not be a separate cure, it can cure with the first skin.

Regardless of whether you are using the red or white foam or plywood, do not change any of the layups of fiberglass or any of the core carving shown on page 13-5 of plans.

Due to excessive costs of the aircraft grade of the R45 dark blue PV core foam, marine grade is being substituted for two of the eight pieces of 0.35" thick R45. The marine grade is identified by a slightly different thickness and an occasional void. Use the marine for the consoles and the aircraft grade for the tank skins. (see page 2-3 of plans).

Also, due to excessive cost increase, the 0.8" and 1.6" thick pieces of R45 are now being supplied in marine grade. The marine grade is available 32" wide rather than the 24" wide as shown on page 2-3. Even though you are getting some excess foam you are paying only half to two-thirds the price of the previous aircraft grade.

Marine grade and aircraft grade PV foam are similar in formula and structural characteristics. The differences are in the occasional voids and thickness tolerance. Fill any small voids with dry micro. Fill voids larger than 1/2" dia. with a foam chip and wet micro.

MIKE AND DICK'S LONG-EZ's By Mike Melvill

Progress has been good since CP #25. All major structural parts are complete, wings, winglets (upper and lower), centersections, fuselages,

canards, elevators, mains and nose gears. Dick plans on completing his in the same building we rented and I have transported mine to our home in Tehachapi, where Sally and I have been working like mad in our two car garage.

At this point our Long-EZ (N26MS November two six, Mike Sally) is on its gear, the canopy is complete and mounted, the engine is mounted. The canard is mounted, without the fairing block. The wings have been mounted and drilled into the centersection, which is hard mounted into the fuselage. The speed brake is installed and operational, pitch trim, roll trim and control sticks are installed. Upper and lower winglets are mounted on the wings, as are the ailerons.

Still left to do, mount the wing strakes (fuel/baggage areas) which will be the prefab parts (see page 1). Fit and install the cowling, install and hook up all instruments, throttle quadrant, and complete all plumbing and wiring. Then of course it is finishing time, lots of dry micro, featherfill, primer and paint.

Sally and I have been trying very hard to get our Long-EZ ready for the Hospitality Club Bahama's trip this Christmas. At this time I am not certain we will make it. To a large extent it now depends on being able to get all the little parts it will take to finalize the whole thing, we will keep on going as hard as we can and it will not be for lack of trying if we don't make it.

During the course of our building we have weighed virtually all the parts and kept an accurate record of man-hours we have spent building. Here is a list of weights and hours spent on the parts. Use this as a guide to judge if you are too heavy, too light or spending far too much time on a part:

Front seat bulkhead	2 lbs. 14 ozs.
Back seat bulkhead	1 lb. 7 ozs.
F28 bulkhead	3 ozs.
F22 bulkhead	1 lb. 7 ozs.
Instrument panel	2 lbs. 2 ozs.
Fuselage sides (with gear attach layup and angles and bolts)	10 lbs. per side
Fuselage, assembled with bottom on and carved outside, but not skinned	41 lbs.
Skinned fuselage, with roll over structure and speed brake (from F22 to firewall)	59 lbs.
Speed brake	2 lbs. 2 ozs.
Main gear strut with 8 ply UND torsional layup	24 lbs. 14 ozs.
Main gear with attach tabs complete	27 lbs.
Centersection spar	29 lbs. 5 ozs.
Wing, skinned top and bottom, no root ribs, ailerons cut out	46 lbs.
Wing, with root rib layups, and aileron trailing edge spar complete (no aileron)	46 lbs. 8 ozs.
Aileron with mass balance, hinges, torque tube and universal	5 lbs. 2 ozs.
Wing, complete to end of Chapter 19, with	

level reference board bondo'd on, ailerons, hinges, controls, etc.	51 lbs. 8 ozs.
Upper winglet with R.S.T. antenna, coaxial cable and BNC connector, ready to install on wing	6 lbs.
Lower winglet	1 lb. 3 ozs.
Canard no hardware, no elevators	17 lbs.
Left elevator, no hinges, no counter-weights	2 lbs. 2 ozs.
Right elevator, no hinges, no counter-weights	1 lb. 13 ozs.
Left elevator, ready to finish	3 lbs. 8 ozs.
Right elevator, ready to finish	3 lbs. 4 ozs.
Canopy complete ready to finish	16 lbs.
Fuselage, complete with centersection (includes side consoles) brake cylinders, main and nose gear (and fore and aft canopy frame) (500x5 tires on main gear) no wingstrakes, no canard, no canopy, no engine mount	183 lbs.
Wing, complete with upper and lower winglet, rudder mounted and hinged, ready to finish and bolt to mounted centersection spar	64 lbs.
Dynafocal engine mount	5 lbs. 3 ozs.

BUILDING TIMES IN MAN HOURS (MH)
Note: These are not just layup times. These are total hours worked for all people, including shop cleanup.

Fuselage, assembled with nose, nose gear, main gear, and roll over structure	86 mh
Main Gear (complete, no axles)	9 mh
Canard	38 mh
Elevators	8 mh (2 pcs)
Centersection	62 mh
Both Wings	97 mh (2 pcs)
Upper winglets	11 mh (2 pcs)
Lower winglets	6 mh (2 pcs)
Wing root layups, aileron cut out and trailing edge spar layups (2 wings)	15 mh
Ailerons, complete, hinged and operational in the wings with controls (2 wings)	32 mh
Canopy complete	36 mh
Wings, jigged to centersection and drilled in	6 mh
Upper winglet, jigged to wing, and all layups complete plus lower winglet, jigged and layed up	23 mh (per wing)
Rudder layout, cutout, layup, mount hinge and bracket, string cable	7 1/2 mh
Total Man Hours to date	458 mh

This is where I am at this time and we will continue to report progress, weights and times in future CPs.

TULLAHOMA 80 by Dick Rutan
This was our first time we had been to this event and thoroughly enjoyed it. Good weather, nice crowds and a lot of fun flying. The side trips to the "Grand-Ole-Opera" and the Jack Daniels distillery were interesting. I flew the Long-EZ each day in the airshow demonstrating it's maneuverability by doing some very basic aerobatics both with and without power.

The event was well attended by VariEzes and all the Long-EZs in the world were in attendance. Johnny Murphy flew his Long-EZ non-stop from Florida. Friday night the EZ crowd got together at the VFW club for dinner. I took the opportunity to give special recognition to some very nice flying machines. I selected John Benjamin N40JB VariEze as the overall winner with Steve Darlington N36SD and Robert Vaughan N66EZ so close behind they also received awards. "Good job guys, it makes us proud to see such fine machines".

The significant part of my trip was the demonstration of the Long-EZ, long range cruise efficiency by flying from Mojave, CA to Tullahoma TN non-stop arriving with fuel to hold almost two hours. Myself and my friend Jeana Farrar with baggage for two weeks flew the 1600 nm (1860 statute miles) in 10 hours 46 minutes non-stop, for an average speed 148.7kt (171 mph). This included a detour to see the Grand Canyon at dawn. The total flying time was 11 hours 6 minutes including holding an arrival airshow demonstration. Total fuel burn was 55 gallons for 4.74 gph. Fuel burn for the leg not counting holding was 53 gallons for 34.7 sm per gallon. Not bad for two people at over 175 mph true airspeed. In August, the non-stop flight to Oshkosh from San Francisco was virtually the same distance and speed as this one. We are very pleased with the data on both of these long flights because it was just slightly better than what is stated in the Owners Manual. Both flights were blessed with good smooth weather and a 3-4 kt average tail wind. At over 12000 ft cruise altitude, we were using only about 58% power. The Lycoming O-235 (at 1500 hours total time) ran smooth with very low oil burn.

On our return trip we stopped off at Ray Field, a little 2000' grass strip just south of Mobile Alabama, to attend a local EAA chapter meeting. Even with trees at both ends the Long-EZ operated out of the grass strip with no problem. I want to thank Rick and Kully Thompson and all the chapter members for replacing our burned-out landing light, and bedding us and the Long-EZ down for the night.

It is very interesting to note that Mojave to Tullahoma via jet airliner requires a 2 hour drive to Los Angeles, a 7.1 hour airline flight (including one stop) to Nashville Tennessee, a half hour baggage pick up and another one and a half hour drive.

MOJAVE TO TULLAHOMA - TWO PEOPLE, ONE WAY

	AIRLINES & CAR	LONG-EZ

TOTAL TIME	11.1 hours	10.8 hours
COST-AIRLINES	$580.00	-
COST-CAR	40.00	-
COST-FUEL AND OIL	-	$88.00
COST-DEPR. HANGER, OVERHAUL, INS	-	$90.00
TOTAL COST	$620.00	$178.00

It may surprise many to find that you can go 3/4 the way across the country faster than airlines and at less than 30% of the cost!

FROM THE BUILDERS/OWNERS
This section contains miscellaneous information received from the homebuilders that may be of interest to others:

FROM LAURENT MORELLE, FRANCE - "First flight 10 July 1980 for F-PYHT and no problem. It is a wonderful machine, I won Grand Champion cup at Brienne Le Chateau show and VariEze G-LASS (Don Foreman, England) won best foreign aircraft. Four other EZ's are flying in France. Mr. Lesschaeve reports the 5 EZ's were at the Brienne Le Chateau including Rudi Kurth (Switerland) and Mr. Ghimbal and Briguet of France. Our development of the nose gear shock strut (CP #25) was preceded by Mr. Bruno Ghimbal who uses a polyurethane damper on his VariEze nosegear. He reports it rides "like a Citroen CX!".

FROM DR. JOHN STEICHEN - "I would recommend the shock strut for all VariEzes. I recently removed the bolt from NG10 and found it bent with no memory of any pot holes".

FROM HARRY JOBES, MICHIGAN - "As a builder of both the VariEze and the Long-EZ, I have had the opportunity to work with both sets of plans. The VariEze plans and instructions are great... but those for the Long-EZ are an order of magnitude better.

Even though, in some areas, the Long-EZ is more sophisticated than its predecessor, the plans are easier to follow. Drawings are more numerous and crisper. Added cross sectional views are a big help. The designation of the layups is a thoughtful feature. The addition of bills of material by chapter and a foam cutting schedule are cost and time savers.

Keep up the good work! I am eagerly anticipating getting my Long-EZ in the air in 1981.

FROM RAY RICHARDS, TOLEDO, OHIO - "After 150 flight hours (VariEze) I disassembled the carb heat muff and found the carbon steel door spring broken into a dozen pieces. To replace, I wound 0.40 stainless wire into a spring on a lathe mandrel. Works great... other than that all is fine and N48EZ behaved faithfully."
Has anyone else had carb heat spring deterioration? Do check for this, it may be possible to ingest a piece into the engine.

FROM IVAN SHAW, ENGLAND - "I use modeling clay to hold jigs temporarily before applying the Bondo, real helpful and easier than playing about with shims. I bettered the wing layup times by using two 2-inch brushes, it doubled efficiency. I'm a drummer and can get 16 stipples

a second! While this works well for a professional drummer, we at RAF still recommend minimum use of brushes. By pouring on epoxy and spending most of the time with many light passes with the rubber squeegee, most people will do fast, accurate, quality layups.

FROM MABEL COHA, SAN DIEGO, CA - She and husband Al recently made a VariEze trip from San Diego to Alaska and back. "On July 19, 1980, Al and I departed from Montgomery Field, San Diego, Ca. in VariEze N2CR. Flight time to Sacramento, Ca. was 3+20. In Sacramento we visited Earl and Barbara Wilson. Barbara designed the VariEze Hospitality Club patch.

Flight time for the second leg to Victoria B.C., past Mt. St. Helens, was 4+41. After clearing customs we renewed acquaintances with Norm Ross and Glenne Campbell, after their visit to San Diego several weeks earlier.

The third leg from Victoria to Fort St. John was flown under overcast to broken clouds with scattered light rain showers. The flight time for this leg was 3+14. We refueled and departed for Whitehorse, Yukon with an ETA of four fours and five minutes and weather forecast of 3,500 foot overcast with light rain showers. Six miles west of Ft. Nelson the clouds merged into the trees. With 5,000 foot peaks ahead, we did a 180 and landed at Ft. Nelson. The flight time for this leg was 1+32.

After two days at Ft. Nelson, B.C. during which time we enjoyed meeting many friendly, curious, interested Canadians, the cloud base lifted to 5,000 feet. We departed for Whitehorse with the usual light rain showers in the mountains. By flying through the saddles, we were able to maintain VFR and arrived at Whitehorse after 3+11 enroute.

The 80 octane fuel truck was broken at Whitehorse so we had to round up some Jerry cans. We departed for Fairbanks, flight time for this leg was 3+30. After clearing U.S. customs and talking to the usual friendly group of people, we parked N2CR in the transient parking area and had dinner with a friend from San Diego who is now working with the Fairbanks FAA office.

After visiting the points of interest at Fairbanks and waiting for the weather to clear, we departed for Anchorage VFR below the overcast again. We spent several days in Anchorage with friends and attempted to attend a fly-in at Soldotna with Fred and Sharon Keller but were turned back by bad weather along the route. We departed for the

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return trip to San Diego in a moderate rain and lowering ceiling getting through Chickaloon Pass before it became closed by weather. We passed through some of the most spectacular scenery in the Wrangell Mountains, a 'short-cut' between Gulkana and Burwash. We cleared customs at Whitehorse after a flight of 3+41 and fueled for Ft. St. Johns.

Again the weather forecast promised scattered to broken clouds and light to moderate rain showers for the leg to Ft. St. John. We were

able to maintain VFR once again and arrived after a flight of 3+54. After fueling for the leg to Victoria we were offered a ride into town, where we ate supper.

That night was the first time blue sky was overhead so we slept on the grass in back of N2CR. The leg to Victoria was flown in 3+43. On the way back to San Diego, we visited Orcas Island, (don't recommend stopping there unless they sweep the stones from the runway), Tillamook, Oregon, Sacramento and Watsonville.
Flying time for the trip was forty-five hours, fuel consumption 220 U.S. gallons, statue miles 7,200.

The scenery was spectacular with gorgeous snow covered mountains, glaciers, braided rivers, lakes, green plateaus, and rocky peaks. Quick changes can occur in the weather in this area at any time of the year. However, June and the first two weeks of July are apt to have the best weather conditions.

We found everyone who saw the VariEze showed much interest in the plane and now feel it should be named "Ice Breaker". It certainly has increased our circle of friends".

The photo elsewhere in this newsletter shows the equipment taken on the trip. Mable carried much of it on her lap! We wonder why someone named Al Coha wouldn't build an Aluminum airplane, or, what would you expect from Mr. E. Poxy!

FROM DAN LUNDBERG, HOUSE SPRINGS, MO - "I will be installing the VariEze rudder cable shortly. One of your newsletters stated that your trim can be eliminated by filling in behind the left rudder after the correct position is determined. Can I eliminate the yaw trim and parking brake? My plan is to ground adjust trim at rudder during initial flight tests and I see no need for the parking brake when parked nose down".

Answer - Yes, Dan, this is the currently recommended procedure for VariEze (CP#24 page 5) and is used on Long-EZ. You will find this better and simpler than the original VariEze trim.

FROM ED ROCKWELL - "I've decided to sell my VariEze, can you advertise it in the newsletter?"

Answer - Due to the inferred approval of airplanes that we do not have control over their quality control and workmanship, we cannot do this. It presents a possibility of liability on our part if it were defective. The builder of a homebuilt should seriously consider the liability aspects before selling his aircraft. Since he is an aircraft manufacturer todays American legal system may charge him for strict liability in tort. What this means is, if the airplane he builds injures someone he may be held liable even if he is not proven to be negligent! It's surprising what a lawyer may dream up if the airplane you built should ever crash. Even though you are not negligent in any way it could cost you more that the airplanes worth just to defend yourself. The following is a true story: An individual conducted all the flight tests of a new homebuilt in a competent and professional manner. He then put it up for sale. A buyer arrived and the seller conducted a full checkout. The buyer nearly crashed on his first

flight due to low pilot proficiency and low threshold of panic. The seller worked with him until his proficiency improved to the point where he was more comfortable, but cautioned him to not carry passengers and to fly in a limited envelope until he had a great deal more experience. The buyer left with the airplane and as soon as he arrived at his destination he took off with a passenger and with the cg out of limits. He crashed, killing both occupants. Now nearly two years later, the seller is being sued for ten million dollars. Because of the present ridiculous legal liability situation we at RAF would never sell any of our experimental aircraft. Both the VariViggen prototype N27VV and the VariEze prototype N7EZ were donated to the EAA museum.

FROM BYRON McKEAN - "I have the Goodyear 6-ply 3.40x5 tires and have ruined 3 inner tubes at the joining of the valve stem to the tube. I enlarged the hole and rounded the edges but it still went flat after 15 landings. Tire repair stations say the rim is too wide for this tire". Ben Duarte machined his wheels (and modified axles) to narrow them to reduce sidewall flexing, as he has had sidewall breakdown with his 6-plies. We at RAF believe the primary cause of both stem failure and sidewall failure is under-inflation. Under-inflation is almost always the cause of stem problems. When we introduced the 6-ply tires in CP #24 (page 7) we recommended a pressure of 80 psi. These tires are rated for pressure up to 95 psi. We ran them at 110 psi for the world record flight (gross weight was 1920 lbs.). We got over 180 landings on the first set and second set of 6-ply tires. We have run them too low (60 psi)for much of their service. We experienced sidewall breakdown in the form of blisters, near the end of tread wear, but never a flat. Because of the reported incidence of sidewall breakdown be sure to carefully inspect tires on your preflight inspections. (last pages of owners manual). If you have had or do have a breakdown or a flat, report it to us, indicating the service life and pressure history. We will access this data to determine if a wheel modification or change in tire specification is to be recommended.

GEHRES AND WOOD'S NACA INLET - TESTED ON VARIEZE N4EZ
Due to the interest many of you have expressed in the flush scoop we decided to evaluate it ourselves. We got the plans from Tim and Steve. They are oriented to installing the inlet on an already completed airplane, but may be used on a new construction project. First, we drained all fuel and oil and removed both batteries, removed the wings, and the canopy. Then we flipped the fuselage over, sat it on two saw horses and weighting the nose to keep it stable. Following the plans pretty close, we sanded the bottom, built cardboard dams, poured 2 part "pour-in-place", urethane foam, carved it to shape, cut down the existing bottom cowl and used blocks of urethane, as well as "pour-in-place" to build it up to the new shape. After it was carved to our satisfaction, it was glassed, filled and painted. The entire operation was accomplished in about 35 man-hours.
TESTING - Before installing the Gehres/Wood mod we carefully conducted baseline tests of ground cooling, climb cooling, cruise cooling and Vh (max speed with best power mixture at several altitudes). We repeated these tests after installing the engine baffling, then again after installing the flush inlet. Two CHT gages and four probes were used. Based on the Gehres/Wood testing, we had expected a large improvement in cooling due to the baffles and some loss of this improvement due to the flush inlet. The Gehres/Wood test results also agree with logic.

However, our test with N4EZ showed no cooling improvement with the baffle modification. A slight reduction in CHT was observed after we curled up the edges of the baffle pieces as shown in CP #22, page 4. Also, we obtained a definite improvement (30 to 35 degrees F) in cooling (CHT) when we installed the flush inlet. We contacted the other two VariEze owners known to be using the flush inlet (Johnny Murphy's Long-EZ and Ken Forrests' VariEze) and they both report an improvement in cooling. The reason for this is unknown, since theory and NACA test show that flush inlets do not have as good pressure recovery as ram scoops.

Our performance test were carefully run to accurately measure the speed change due only to the flush scoop. Full-throttle speed increased an average of 2 1/2 to 3 knots at density altitudes of from 4,000 ft. to 12,000 ft. Ken Forrest reported no speed change, but it's possible his test were not as accurately run. Johnny Murphy reported a larger speed increase, but he made other improvements at the same time.

To summarize: You can pick up a little speed (approx. 3kt.) and your engine will probably run a little cooler in level flight with the modification. A lot of people like the look of the airplane better with the "flush" NACA inlet (we call it the "female EZ").
Plans for the installation of new baffles and a NACA inlet for a VariEze or Long-EZ, are available for $20.00 from:

Wood and Gehres Inc.
105 Appleblossom Court,
Orlando, FL 32807

The plans are well done and easy to follow. They require you to discard the normal cowl-inlet and patch into your existing lower cowling. If there is sufficient interest in the NACA inlet we may consider investing in tooling to produce a new bottom cowl (or forward part of a bottom cowl) and the inlet (two molded parts that will bond to fuselage). If you would like us to see if these parts are available, please write in to RAF.

PROPELLERS
In CP #25 we announced the Great American Propeller Company (GAPC) as a recommended propeller manufacturer. Their 56x68 prop was one of the best we have tested on the Continental 0-200 VariEze.

We have just completed an evaluation of their 58x65 prop on the Lycoming 0-235 powered Long-EZ. The prop gives excellent performance and meets or just slightly exceeds the speeds listed in the owners manual. We are happy to recommend this prop to any Lycoming 0-235 powered Long-EZ flyer. The following is a current list of recommended propeller manufacturers:

Larry Weishaar
1924 No. 6th
Springfield, IL. 62702
(217)544-6086
(Homebuilt Props)

Ted's Custom Props.
Ted Hendrickson
9917 Airport Way,
Snohomish, WA 98290
(206)568-6792

B & T Propellers
5746 Ventura Ave,
Ventura, CA 93001
(805)649-2721

Bill Cassidy
4652 Montview Blvd,
Denver, CO 80207
(303)322-3423

Ray Hegy
Marfa, Texas 79843
(915)729-4249

The Great American Propeller
555 West Mont Drive #212
San Luis Obispo, CA 93401
(805)481-4450

EZCALC ELECTRONIC INSTRUMENT UP DATE
IN CP #24, page 7, we talked about an electronic unit that would give instantaneous fuel flow and trip average. Additional displays: Total fuel used/remaining fuel/distance/time to arrival and also to dry tanks. (Pilots in-puts ground speeds). Battery voltage, OAT, CHT, RPM, EGT, fuel low warning, clock, local, zulu time and approach timer. This all in a 3"x6" vertical oriented box. The developmental program is still in work, but delayed. We are currently expecting deliveries in February 1981. We should have an update in CP #27. Note: Long-EZ or VariViggen only. Installation requires fuel pressure, so this cannot be used on a gravity-feed VariEze.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as the FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas, the FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft in proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

CATEGORY	DEFINITION
MAN-GRD	MANDATORY, GROUND THE AIRCRAFT. DO NOT FLY UNTIL THE CHANGE HAS BEEN ACCOMPLISHED.
MAN-XXHR	MANDATORY, ACCOMPLISH THE CHANGE AT NEXT CONVENIENT MAINTENANCE INTERVAL OR WITHIN XX FLIGHT HOURS, WHICHEVER COMES FIRST.
DES	DESIRED - STRONGLY RECOMMENDED BUT NOT REQUIRING GROUNDING OF THE AIRCRAFT.
OPT	OPTIONAL - DOES NOT EFFECT FLIGHT SAFETY.
OBS	OBSOLETED BY A LATER CHANGE

MEO MINOR ERROR OR OMISSION.

LONG-EZ PLANS CHANGES

LPC #29, MEO, page 16-3.
CS119 should be 4.1" not 3.1"

LPC #30,MEO, page 10-3.
Upper right drawing #3 holes should be 1/4".

LPC #31, MEO, page 19-5.
Lower left paragraph, 3 plies should be 2 plies.

LPC #32, MEO, page 19-3.
Last paragraph, third sentence between "at" and "12" add "the correct place at the wing top. Hot wire "0" to".

LPC #33, MEO, page 11-2.
Lower left side, 3 lines up - should be 2 strips, not 3 strips.

LPC #34, MEO, page 2-1.
LMGA is used in Chapter 5 not Chapter 9.

LPC #35, MEO, page 9-1.
Landing brake paragraph - after the word "installation" add the words "and other important landing brake details".

LPC #36, MEO, page 19-15, page 19-16.
Clarification: CS127 can be made from the drawings on these two pages. Use .032" 2024T3 aluminum.

LPC #37, MEO, page 8-1.
Sides of roll over structure should be 13" not 12.7".

LPC #38, MEO, page 10-3.
Two places, cut 12 pcs. UND should be, cut 6 pcs. UND.

LPC #39, MEO, page 26-1.
"VariEze canopy (Chapter 22)" should be "Long-EZ canopy (Chapter 10)".

LPC #40, MEO, page 16-3.
The AN 315-3 jamb nut shown is not supplied in the bill of materials. It is satisfactory to substitute a MS21042-3 nut. Run a 10-32 tap through the MS nut before installation.

LPC #41, MAN GRD, page 33, Owners Manual.
After "70 to 80 psi" add "75 to 85 psi for 6-ply tires".

VARIEZE PLANS CHANGES
MAN, 100 HR, Sect. IV, pg 39.
Wing Attach Bolts - two builders have found corrosion in the wing attach bolts. Add the following to your owners manual: "Remove and inspect your wing attach bolts for possible corrosion annually or each 100 hours. Spray LPS #3 on the bolts and taper cones before reinstalling them, this will give excellent corrosion protection".

DES, Section I, pg 6-5
Add the additional information for attach fitting layups shown on page of this newsletter, CP 26.

MAN-GRD, Sect IV, page 33
After 55 to 65 psi add "(75 to 80 for 6-ply tires)"

VariEze Builder Hints

VariEze wing attach fitting layups, centersection and wings. Builders continue to have difficulty in achieving the proper layup thicknesses. The BID pads (8 places) must be laid up, weighted and cured per CP 15, page 6 or per Chapter 26 (second edition plans). For the number of plies of BID in each pad, use the table below, not the plans.

Now, after the BID pads are cured but before laying up shearwebs, spar caps or skins, measure the "X" dimension (top of BID pad to top of WA3 or WA5) and compare it to the table below . "X" must be at least the dimension shown, if not, sand the BID pads down before continuing. This step should eliminate buildups too thick to fit between the metal plates.

	# Plies in BID Pad	Minimum Dimension "X"
Wing Top	11	0.196"
Wing Bottom	14	0.151"
C/S Top	16	0.160"
C/S Bottom	19	0.124"

SKETCHES OMITTED

CP26, Page 6

LONG-EZ BUILDER HINTS
Wing jig Templates - Clarification - after gluing the 'A' drawing together, connect the W.L.'s with a straight edge. This will make it a lot easier to get things straight, and will be a check that the drawings don't warp when glued down. When Dick and Mike built their Long-EZ wings, the jigs fit the foam cores well except at the leading edges, where a gap of 0.1" and 0.4" was apparent between jigs and foam cores. A few builders have found this as well, and a few have reported that their's fitted tight. The jigs are sized to be a bit loose to avoid interference with the foam core and possibly there is some paper stretch or shrinkage during gluing. If you have a gap, it is not a problem. Go ahead and align the foam cores using the trailing edge as a reference, (butt core T.E. to jigs) and center the leading edges of the foam cores in the jigs, accepting the gap as shown.

SKETCH OMITTED

Wing Spar Caps - We have found a good way to clamp the spar caps during cure to get minimal waviness and to force them down level with the wing cores. See the accompanying sketch. Select some hot wire cuts of styrofoam (left over from wing core cutting) about 1" to 1 1/2" thick

and cut them 4" wide. These should be covered on one side with grey duct tape for a release, and you should cut and fit them end to end to go the length of the spar cap. Get these prepared before doing the cap layup. Now layup the cap normally, squeegee it out properly, then carefully place the foam pieces (with duct tape down) on top of the wet cap. Weight the foam down evenly with lead shot bags, milk jugs full of sand, salt bags or whatever. This will pack the cap layup down evenly and result in less sanding before the skin layup.

Canopy - page 18-2. Do not compromise the "A" dimensions, this 13 1/2" is required for good forward visibility. If it is desirable to lower the aft end of the canopy to better fair it into the cowling, or to meet the "B" dimension, it is structurally OK to remove the flange from the plexiglass aft of the roll over structure.

SKETCH OMITTED

When you get your canopy, do check a couple of dimensions: measure from the point of the plexiglass nose, aft 27". Now squeeze the sides in at the 27" point, till it measures 18.5", hold a straight edge across at this point, an measure up to the inside top of the canopy. For it to fit a Long-EZ satisfactorily this dimension should be from 11.25" to 12.75". If it is less than 11.25" it would reduce forward visibility by forcing the pilots head too low.

WING ATTACHMENT - Follow the instructions on page 19-18, step 1 except drill the 1/4" holes through the forward face and the aft face of the centersection spar. Now follow through step 2 and use two sawhorses/boxes per wing, with blocks of foam left over from the wing to bring the wings up close to the height of the centersection spar. Now cut 4 foam wedges 7" wide, 2" thick tapering to nothing. These are used to fine tune the height of the wing at the centersection spar and the tip. Now get a suitcase strap, rope or several belts and strap the inboard wing to the centersection spar. This stabilizes the wing against the centersection spar, and stops it from moving fore and aft and in sweep while you adjust the tip and root for correct relationship to the spar. Cinch the straps tight, double check that the wings fit well to the centersection and especially important the the incidence is correct (of course, the fuselage must be level). Four large 'blobs' of bondo (about 3/4" diameter) are placed roughly above and below the hard point. Allow this bondo to cure completely, before you attempt to drill the 6 mounting holes. Now, run your long 1/4" drill through the centersection spar and drill through the "hard points" in the wings. You are now ready to enlarge all six holes to 5/8" diameter, using your spotface tool. As you drill into each "hard point" the 5/8" spotface will break through each lamination of glass and aluminum. You will find that the spotface will break loose a thin "washer" of glass or aluminum located on its cutting edges each time it breaks through a layer. At this point it can no longer cut, and you must withdraw the tool and remove the small "washer" or "disc". Do not try to drill all the way through one hole in one operation. Clear the spotface often, and every time it breaks through a layer of glass or aluminum. It is a good idea to move from one hole to another to allow each hole to cool off. You must not get the wing fitting area hot, so go slowly and carefully, clearing often, and if necessary, stop and allow things to cool. We have found that this entire set up, jigging and drilling both wings to the centersection, takes about 5 hours, 2 hours just for

drilling. If you are building your Long-EZ in a 2 car garage, you will have to take it outside to do this set up. Be sure to protect the fuselage and wings from direct sunlight with white bed sheets or newspaper.

We found that our spotface tool tended to bore a hole as much as .007" over its intended .625" size. This results in a loose fit on the LWA9 bushings. It is satisfactory to fill this void with wet flox when installing the bushings. It is recommended that this flox be cured while the wing is bolted to the centersection spar. This assures perfect alignment of the bolt holes.

FINISHING - CAUTION! Do not ever wipe paint thinners on any part of your structure. Minute pin holes in the epoxy/glass skin can allow the thinners to penetrate down to the styrofoam, which dissolves in thinners. This can cause the skin to debond from the core. For the same reason, care should be taken to fill any possibly dry areas (presence of air voids) or areas with pin holes, with epoxy, before applying featherfill or primer, both of which contain solvents that can attack the styrofoam. Epoxy wiped onto the surface with a rag should be sufficient to seal layups that otherwise maybe dry enough to allow thinners or primers to penetrate. The surface must be sanded after epoxy cure.

MAIN GEAR ATTACH - A builder has suggested using left over scraps of R45 (dark blue) foam in the landing gear attachment area where we call out using urethane foam. This is fine, although not as easy to carve down to the wood longerons as the urethane.

AILERONS - Use care on the leading edges of ailerons to get the full radius around the mass balance without a sharp edge. A sharp edge will cause early airflow separation on the up-deflected aileron and will reduce roll power.

SKETCH OMITTED

LANDING BRAKE INSTALLATION - Page 24-1, the sketch showing LC1, does not show the cutout necessary for the seat belt clearance. Before bonding LC1 into place, make the cut out per the right side.

SPEED BRAKE RIGGING - Due to the fuselage bottom on the Long-EZ being thinner than the VariEze you may have to shorten the LB21 pushrod (turn a few more threads on it with a die). When rigging the speed brake, be sure to obtain the correct amount of offset with the brake in the down position. The top rod end must be 0.4" aft of a straight line drawn between the upper and lower pivots. It is acceptable to vary the 0.4" dimension + or - .1" as required to obtain the 40 lb. brake closing force.

SKETCH OMITTED

LONG-EZ COM ANTENNA - At last, a high performance com antenna. Jim Weir from Radio Systems Technology developed a com antenna for the Long-EZ that fits in the winglet. (see photo) We have tested it in the Long-EZ N79RA and found it to have excellent range. We were able to use it at distances of over 80 nm. The antenna uses copper foil and RG58U lead in. It does not require a ground plane. It can be

installed on the foam core before glassing and is completely enclosed within the winglet. Ours was placed on the outside skin after drilling some carefully-aimed holes. Install the antenna system before glassing the inboard side of the winglet. Cut 2 strips of copper foil 20.3" long, remove the protective backing and stick the foil to the foam one inch from and parallel to the trailing edge. Measure the rudder cut out area and bend the lower (2") end of the foil forward to miss the rudder. From where the two foil strips come together cut a slot just deep enough to hold the RG-58U/A lead in cable flush with the foam surface. Hold the lead in with toothpicks similar to the method used on page 19-7 rudder conduit. Be sure the three Ferrite Balums are installed just above the connection as shown. Solder the center wire of the RG-58U/A to the top foil strip and the outside "ground" braid to the lower foil strip.

Be sure the upper and lower foil strips don't touch or short out. Use about 1/8" separation. Check that none of the wire, ferrite balums etc. stick up above the foam surface, trowel in dry micro around the solder joints and other voids and glass the inboard winglet as per the plans.

Coil up the excess cable and thread it through the wing during winglet installation.

The antenna kit is available from:
Radio Systems Technology
10985 Grass Valley Avenue
Grass Valley, CA 95945

Antenna kit price -
Assembled - $25.50
(with BNC connectors)
Unassembled - $15.00

SKETCH OMITTED

CP26, page 7

NOSE TIE-DOWN FOR THE NOSE-DOWN PARKING

In order to tie your Long-EZ or VariEze down when parked nose-down (best way for high winds), we recommend installing this simple tie down, which is located at F.S. 1.5" and W.L. 8.9". The tie down consists of an aluminum tube floxed into a hole in the side of the nose, oriented horizontally. A removable steel tube slides into this aluminum tube and locks with 90 degrees of rotation. The steel tube protrudes approximately 2 1/2" out of the left side of the nose, and has a steel ring welded to it, so that when the steel tube is pushed in, turned 90 degrees to lock, the steel ring points at the ground.

SKETCH OMITTED

Materials required:
Part #NTDA 1 pc. 7/8" O.D. x .058" wall x 7 1/4" long, 6061-T6
aluminum tube
Part #NTDB 1 pc. 3/4" O.D. x.049" wall x 10" long, 4130N
steel tube

1 hardware store type 2" diameter steel ring (3/16" or 1/4" wire size)
1 AN3-11A bolt
1 MS21042-3 nut

On a new Long-EZ, the best time to install the nose tie down is in Chapter 13, page 11. With the top of the nose cut off to fabricate the nose door (step 9), drill or cut with a dremel a 7/8" diameter hole through the left side at F.S. 1.5" and W.L 8.9". This hole must be drilled through both NG30's as well. Before installing NDA tube, drill a #12 hole through it, 3/4" from the inboard end. When you slip the NTDA tube into the holes it should lie right against the NG31 bulkhead. NTDA should be sanded dull with 220 grit, and should be floxed in with wet flox. One ply of BID should be layed up over the tube onto the NG31 bulkhead on both sides. Orient the #12 hole vertically and install the AN3-11A bolt and nut. Allow this to cure.

NTD-B is a 10" long piece of 4130N steel tube with a 2" diameter hardware store steel ring welded close to one end per sketch. The other end is slotted and notched so that the ring is held horizontally facing forward, while NTD-B is slipped into NTDA. The slotted end locates over the AN3 bolt, then the NTD-B tube is rotated 90 degrees to orient the ring vertically down, pointing at the tie down.

To park the airplane, park it with the tie down ring directly over the normal "tail" tie down rope, and snub it down firmly. The large ring allows you to use ropes or chains normally found at airports.
SKETCHES OMITTED

VARIEZE BUILDERS

Installation of Cowling Trailing Edge Closeout. This cowl is not supplied with a trailing edge close out piece. This is custom-laid by the homebuilder to assure an accurate fit.

Apply shiny-surface grey duct tape on the inside TE of the bottom cowl half as shown. Sand dull, the top cowl TE. Jig TE down, with the TE taped together and with the front opened 8 1/2" as shown. Cut 10 strips of 45 degree BID 4" wide and 24" long and 2 strips of 45 degree 3" wide and 24" long. Now, layup the 5-ply BID TE close out. Cure, then pop off the bottom cowl and layup the 1 ply BID ply lapping onto the top. Trim the closeout to 1.6" as shown. This TE close out will have four equally spaced fasteners on each side. (three for Long-EZ).
SKETCHES OMITTED

VARIVIGGEN NEWS by Mike Melvill

In early September this year, I was fortunate enough to travel to the east coast (airlines, not by Viggen!) where I visited with Arthur Schwartz, whose VariViggen was ready to fly, at the Soffolk County airport on Long Island.

As you can see from the photo Arthur's Viggen, N37678 is a fine looking aircraft. He had already weighed the plane several times on two

different sets of scales, his Viggen weighs 1154 lbs (empty weight), and his cg came out very well. We spent several hours going over the control system, and generally checking the security of everything. Arthur had done an excellent job, so any further dilly-dallying was only wasting time. We gassed it up and I "drove" it around on the ramp and taxi-ways to get the feel of it and to familiarize myself with the cockpit and systems.

A couple of high speed taxi runs down the runway, lifting the nosewheel off, felt really good, the Viggen tracked straight as an arrow and has effective brakes. I taxied back to where Arthur was standing on the ramp, and told him to get his camera ready.

The tower cleared me for take-off so I taxied out onto the runway and lined it up with the centerline. Power was brought smoothly up to full throttle and acceleration felt about the same as mine (N27MS). The most noticeable thing to me on takeoff was the relatively flat deck angle at lift-off compared to N27MS. Arthur's Viggen has the S.P. outboard wings, N27MS has the standard wings. The difference in pitch attitude at liftoff is almost 3 degrees due to the SP wing and the fact that Arthur's Viggen is almost 100 lbs lighter than mine. He has a Lycoming O-320 160hp. Even so, Arthur's Viggen was airborne considerably before I expected it to be. My Viggen is normally rotated to what seems like a very steep angle (6 - 7 degrees) then it rolls for a while on the mains before the wings take all the weight, and it lifts off. Someone familiar with a standard wing VariViggen, flying an SP wing, will be surprised when it "levitates" into the air at a relatively low angle.

After lift-off, the airplane felt solid and responsive. I rocked the wings briefly, pitched it up and down, asked myself "was I holding the airplane one way or the other?" The answer was no, it was in excellent trim. I continued the climb to 3000 ft above the airport, where I throttled back to keep the airspeed from going over the gear down speed of 125 mph. I flew around for 40 minutes, generally checking trim roll response, pitch response and control authority. The engine ran flawlessly, all temperatures remained in the "green". The first landing was amazingly easy, even easier than N27MS, there is a tendency to float if you are too fast, but it lands very slowly and uses very little runway.

We looked it over carefully, added a little gas and I went up again to look at stalls, slow flight etc. The SP wing and lighter weight is very noticeable in low speed performance. It hung on with no problem down to 40 mph indicated. This is below normal stall speed, so there must be some system or indicator error. N27MS will fly at 55 mph indicated, although at a higher angle of attack. The biggest difference between the SP wing and the standard wing in the stall is that if you get the controls crossed the SP will drop a wing, the standard will not.

One strange thing showed up on Arthur's Viggen. I was not able to go very fast due to the decision to leave the gear down but at 110/120 mph at higher power settings in level flight, there was a noticeable tendency to pitch nose down, something my Viggen or Burt's Viggen has never done. Even at 200 mph indicated. This remained a mystery until after I returned to Mojave.

Unfortunately, the next morning while taxiing very slowly, the right main gear collapsed, due to the pin in the cable pulley, (first edition plans, cable driven main gear) shearing, which allowed the down lock to disengage. When I turned left, the right gear folded inboard, allowing the airplane to come down on the right wing tip, breaking off the lower winglet. Needless to say, this put a stop to further flight testing, so I returned to Mojave.

I am happy to report that Arthur has already repaired it and has about 6 hours on the airplane at this time. He has now raised the gear and has been able to increase his speed, however still is getting the nose down trim situation. While on the phone to him last week, Burt and I determined that instead of 2 degrees of down thrust, Arthur had inadvertently built in 2 degrees of "upthrust"! This is probably the reason for the nose down trim he is seeing. Arthur has promised us a report as soon as he has checked it out.

FLASH!

Just received more information from Arthur. He made external templates of his outboard wings and from these we have determined that he does not have enough 'washout' outboard of the ailerons. In fact this deficiency in washout calculates to be equal to 3 degrees of reflex. This together with the "upthrust" he had built in, undoubtedly accounts for the nose down pitching moment. We have given Arthur the information he requires to correct the problem, and will report on his findings as they become available.

This does bring up an important point, and we should all learn from this example. Just prior to glassing the top of your outboard wing, you must check the washout. This is done by putting the inboard and outboard hot wire templates back onto the foam cores and checking that the waterlines (level lines) are level to each other. This is extremely important. Do not omit this step! Once the top skin is on, this is very difficult to correct.

Oshkosh '80 - Sally and I flew out in N27MS and we flew in loose formation with Burt and Pat in the Defiant. We had an outstanding trip, flying from Mojave, via Zion National Park to Page, AZ. We then flew up the length of Lake Powell (unbelievably beautiful) directly over the continental divide to Denver, where we had lunch. From there to Omaha where we spent the night. The next morning we flew directly to Oshkosh, arriving at noon on Friday. N27MS performed well with the exception of wearing out a brush in the alternator just after leaving Omaha. The nice thing about having a 35 amp hour battery is that it presented no problem and Alcor supplied us with a new brush free of charge at Oshkosh (old one was defective).

While at Oshkosh, though the starter went bad, but again we were fortunate enough to be able to obtain a replacement through Basler, the FBO at Oshkosh. I flew the Viggen in the fly-bys several times and in a three ship formation demo four times during the week. We had a lot of Viggen builders come by the airplane and the RAF booth, and quite a few builders are getting close to flying. It was great to be able to chat with so many guys at one time who were building the same airplane.

We at the RAF booth and myself especially, were extremely busy all week and really was sorry not to be able to spend more time with Viggen builders, maybe next year we can set up a day or two where we could have a bull session on the flight line at N27MS.

Other than very bad weather for the first two hours (we made two 180's!) we had an excellent flight back to Mojave via Rapid City, S.D., Salt Lake City, Utah and Las Vegas, Nevada. We put 30 hours on the Viggen and she now has 460 hours total.

VARIVIGGEN PHOTO OMITTED

ACCIDENTS

The CP Newsletter reports accidents and discusses their conditions and causes for information purposes for all operators. We have always investigated accidents in the interest of determining information that we can disseminate to you to prevent recurrence. It should be recognized in our discussion of accident conditions or causes that generally this information is preliminary since it is published before the availability of the FAA accident report.

1) An Illinois VariEze crashed on landing approach, fatally injuring the pilot/builder. The pilot had turned sharply from a low slow downwind and failed to upright the aircraft. Impact was 150 feet short of the end of runway. Weather conditions were low ceilings and strong gusty direct crosswinds of about 25 mph. The pilot was thrown forward through the instrument panel and clear of the fuselage. The seat belt (EON 8000 type 4) was found open. (see CP 24 page 4). This airplane had previously been damaged when landed short of a 5000 ft runway.

2) A VariEze crashed as it entered the downwind leg of the busy approach pattern at the Oshkosh EAA convention. The aircraft was observed to maneuver erratically then turn and dive at very high speed, with high power maintained to impact. Both occupants died immediately. The aircraft struck a concrete street in a near vertical (60-70 degree) dive, at a low angle of attack. A pilot witness 200 feet away observed that it did not appear that the pilot was attempting to pull out of the dive. This points to a possibility of either a pitch control system disconnect or pilot incapacitation. All but two parts of the control system were found - they did not indicate control system disconnect. The aircraft did not have a rear seat control stick. Thus, pilot incapacitation is the suspected cause.

Destruction of the aircraft was unbelievable, only small parts remained. The engine struck the concrete road at the same point that the nose did. The bow shape of the main gear strut was clearly imprinted on the concrete at the impact point.

Initial investigation at the scene of this accident suspected fuel starvation because there was no evidence of fuel and there was no fire. It was determined that the tremendous force of the estimated 200 mph impact resulted in a fuel and oil explosion, however there was no resulting fire. There have been no fires associated with any VariEze accident.

3) A Washington state VariEze crashed on approach while making a series of touch and go circuits. It was observed on a high final when the pilot initiated a sideslip. The airplane then rolled inverted and the pilot attempted to pull out in a reversing direction. Insufficient altitude was available for the pullout. The aircraft struck the ground in a near level attitude removing the landing gear and the bottom of the fuselage. The pilot's injuries were fatal. The departure that rolled this aircraft over appears to be the winglet stall discussed in CP #22 page 7 and 8. While the pilot appears to have disregarded the operational limitations recommended, this still should not have resulted in a departure. We intend to inspect the winglet contours of this aircraft to determine if any variances may have changed its susceptibility to winglet stall.

To prevent possible recurrence of this type of accident we urge all VariEze operators (does not apply to Long-EZ or VariViggen) to again review the information on page 7 and 8 of CP 22. Check your rudder rigging, wing cuffs, and winglet contours. In addition, to determine the actual departure susceptibility of your particular aircraft, conduct the following test at an altitude of 10,000 feet: full rudder sideslip, abruptly applied left and right at speeds of 100 kts, 90 kts, 80 kts, 70 kts, and full-aft stick. Your airplane should yaw, under control, with no tendency to stall or roll off. If your airplane has any undesirable characteristics, report these to RAF so we can analyze the causes and the extent of any variations.

4) A VariEze pilot ran out of gas on an extended trip. He selected the fuselage tank, restarted the engine and continued, overflying one airport, attempting to stretch his range to another. Total fuel depletion occurred several miles short of his destination. His forced landing was downwind in a turn. The airplane was damaged extensively and ended upside down. There were no injuries.

5) A Nebraska VariEze equipped with the original 2-ply tires, was making a gross weight takeoff. The pilot began rotation at 85 or 90 mph, (above the normal lift off speed of 75 mph), when the right tire blew. He aborted the takeoff, using left brake all the way to stop to maintain directional control. He reported it was not hard to control even though the right brake bleed failed and the right wheel pant and brake rotor was destroyed. His gear strut was the original configuration, not reinforced. He placed the right wheel up on a dolly tilting the aircraft with most of the weight on the left wheel, then pushed it half mile to a hangar. On arriving, the left gear strut buckled a few inches above the axle, inside the tightly-sealed, non-vented wheel pant. The cause of the strut failure was heat. The long, continuous high speed braking resulted in a very hot brake. This heat, sealed in by the wheel pant, slowly permeated the fiberglass strut allowing it to soften and buckle under load. Lessons learned: Do not use the two-ply tires. Ventilate the top of your wheel pants. If unusually heavy braking is done, 'set' the gear to relieve load or jack the airplane to relieve stress while the strut cools. Glue a piece of your fiberfrax fire wall insulation material to the strut (use silicone rubber adhesive) adjacent to the brake disc. Your VariEze and Long-EZ should lift off and land at under 65 kts and 60 kts respectively, unless you have an airspeed instrument error or airspeed position

error. Leaving the airplane on the ground above this speed increases tire stresses and reduces tire life.

SHOPPING
Engines for Sale -

Continental O-200 with factory installed engine-driven fuel pump (as removed from a Champion Lancer). 275 hours since new.
Jim Gibson
788 South Third Street
Terre Haute, IN 47807
(812)232-4912

Continental O-200 run out for $900. Call after 6:00pm.
Jerry Keller (402)772-3701

Continental O-200, 500 hours since major.
Les Boyer
RR #4 Box 259
Festus, MO 63028
(314)937-6014

O-235-C1 OSMOH, 2000 hours total time. $3,350 plus crating charge.
Harvey Bolin
Brandon, MN
(612)524-2229

Continental C-85-8, 6 hours since overhaul. New slick mags, Stromberg Carb. $2,550.
Joe Moore
11320 Hubbard Road
Grass Valley, CA 95945
(916)265-4952

Continental O-200 Zero SMO for VariEze including engine mount, prop extension, Ted's prop, Jiran cowling. Complete package $4800.
No collect calls
(415)757-3621

Continental O-200 A crankcase, accessory case including oil pump. Standard cam journals $450.
Donna Stubbs,
15150 Magnolia
Apartment 217
Westminster, CA 92683

VariEze Dust Cover as seen on Herb Sander's VariEze at Oshkosh (N70VE). Excellent quality, covers entire airplane. $129
Herb Sanders
P.O. Box 18690
Memphis, TN 38118
(901) 365-7606

B & C Speciality Products has developed a lightweight aircraft power generating system. This system was specifically developed for today's weight-sensitive homebuilt designs and has undergone extensive in flight service testing.

Two models are available, one is a gear driven alternator. This bolts onto the alternator pad on the accessory case of the C-85, C-90 and O-200 engines. The other alternator is belt driven, designed for the Lycoming O-235. Can also be adapted for other engines. The complete alternator system weighs only 4 1/4 to 4 3/4 lbs., depending on the type of drive.

B & C Specialty Products,
518 Sunnyside Ct
Newton, KS 67114
(316) 283-8662

Note: RAF is currently testing the B & C lightweight alternators on our VariEze and Long-EZ. Their kit is very nicely done and easy to install. Performance and support by Mr. Bill Bainbridge has been excellent. Many of you saw these at Oshkosh.

PHOTOS OF B & C ALTERNATORS OMITTED

John Friling made his own lightweight alternator for his Continental powered VariEze. John purchased an alternator from a Yanmar Japanese garden tractor.
Part # 942131-41410 (stator)
Part # 942741-42299 (magnet wheel)
Part # 49-401-01 (Kohler regulator, 15 amp)
John used his old Continental generator shaft, bearings and flange, (see photos). John has a really nice set of drawings for those of you who would like to make one like his.

John Friling
852 Westgate Drive,
Addision, IL 60101

PHOTO OMITTED

PHOTOS OF THE WOODS/GEHRES-DESIGNED FLUSH SCOOP OMITTED

Prefab Parts, New Unsused, in the original cartons.
VariEze fuel tank laminates
VariEze nose gear strut (NG1)
VariEze nose gear strut cover (NG2)

Harry Jobes,
1005 Red Mill Dr.
Tecumseh, MI 49286
(517) 423-8226

Hand carved Long-EZ pins. Available in Sterling silver for $50 or 14 K gold for $500. Approximately 2" wing span.
Charles Gray
6893 Seagrape Terr.
Miami Lakes, FL 33014
(305) 822-5040

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Mike, installing the RST antenna on N78RA Long-EZ. Note: this antenna will not fit the VariEze.

Line up of EZ's for the Oshkosh Airshow flight.

The "Real" George Scott

Photo from back seat of Long-EZ at the Oshkosh flyby pattern.

Arthur Schwartz' new VariViggen.

Al & Mabel Coha with baggage for their Alaska trip!

Johnny Murphy checking the torque of his prop bolts.

Steve Darlington going out to fly.

Rich Himrich at the Oshkosh airshow line up.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Mom & Pop Rutan, Fred Keller, Sally Melvill, Pat Storch, Burt & Mike shortly after Fred won the "Lindy" for the Grand Champion Homebuilt.

Super immaculate engine installation on Fred Keller's VariEze.

Darrol Stinton, of British CAA after his flight evaluation of the Long-EZ.

Mike & Sally's Long-EZ, mating the wings

Fred's cake at Anchorage party.

Fred's cockpit.

The Lycoming on Mike's Long. Due to the tight fit on many parts we are shifting the engine down and aft. These changes will be reflected on Brocks mount and on the new edition of Section IIC.

LONG-EZ

FAST - EFFICIENT - HIGH UTILITY - LONG RANGE

Long-EZ N79RA with 75 gal. back seat tank during the world distance record flight. **PHOTO OMITTED

THE AIRPLANE

The Long-EZ is a small, high-performance, high-utility homebuilt sportplane. While recommended mainly for Day-VFR operation, competent pilots can also equip it for night and IFR flying. Power plant is either the 0-235 Lycoming or the 0-200 Continental. It has an alternator-powered electrical system and can be equipped with electric engine starter. It's cockpit layout is designed to compliment pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wing strakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 P.V. core foam. (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal or wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

TRAVELLING MACHINE

At last, an airplane that is specifically developed for efficient, high speed, long-range travelling with room for two adults and plenty of baggage. Fuel allowance with two adults is 38 gallons. Single-place, you can carry 52 gallons! If you're in a hurry, you can cruise at 75% power at 8000 ft at 185 mph (161kts), burning 6.51 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles), in 5.2 hours with a 40 minute fuel reserve. If you're not in a hurry, you can cruise "economy" at 12000 feet at 144 mph (125 kts), burning only 3.52 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 10 hours with a 40-minute fuel reserve. Single place, using the entire 52-gallon fuel capacity, stretches the maximum range and endurance to over 2000 miles and 16 hours!

The high efficiency, long-range capability increases a pilots options for fuel availability and weather detours. The fact that the Long-EZ can carry the same load and fly as fast as other 160-180 horsepower aircraft, means large fuel savings - 29 mpg at fast cruise, 41 mpg at economy cruise.

UNUSUAL EFFICIENCY

The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a worlds distance record, and landing with enough fuel to surpass 5000 miles. At that, it's capability was not taxed - it's initial climb rate was over 600 ft/mn! At light weight, it climbed to

27000 ft in still air - an altitude unheard of for a fixed-pitch, non-turbocharged airplane. Our Long-EZ is so efficient, the engine can be shut down while at 5-ft altitude over the numbers at only 120 knots, then it can pull up, fly at 360 degrees pattern and land on the same runway - completely without power! It's power-off glide angle is only 3.7 degrees - thus a belly-mounted drag devise (landing brake) is used for landings.

SUPERB FLYING QUALITIES
Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and safe stall characteristics. It can be maneuvered sharply, even to full aft stick, without fear of stall or spin. Flight tests show the prototype to be free from stall departures and spins for all types of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed.

Trim changes due to power, gear retraction or landing brake are all very small. It's wide cg range allows a large range of pilots or passengers weighing up to 240 lbs.

The Long-EZ's approach and landing speeds are 75 mph (65 kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.

THE HOMEBUILDER SUPPORT
The Homebuilder support. The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

THE TEST PROGRAM
The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

COST AND BUILDING TIME
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, VFR instruments, plumbing, tools, tires, wheels, brakes and upholstery (cushions and special suitcases) costs about $2,900. Any of these items can be purchased separately. We strongly recommend that you get the distributor's catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

The S-glass roving molded structural fiberglass main gear and nose gear are available from RAF, at $277.95 and $49.75 respectively. Many other

prefab parts ranging from propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased from the listed manufactures. All those prefab parts cost approximately $1,600 - and using them, the competent builder can build a Long-EZ in as little as 800 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above cost of the prefab items. Contact the manufactures for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

Engine costs vary widely. Our prototype has an 0-235 Lycoming that had 1400 hours, when purchased for $1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from $3000 to $6000. Engine accessories, such as instruments, prop extensions etc cost about $300 to $500. In summary then, total cost can run from $5300 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $9900 for everything available purchased and a zero-time engine. IFR avionics can add from $2000 to $15,000 to those numbers, with many options available.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.
Empty Basic	710 lb.
Empty Equipped	750 lb.
Solo Weight	960 lb
Gross Weight	1325 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	550/830 ft
Climb (solo/gross)	1750/1350 fpm
Cruise 75% 8000 ft	183 mph
Cruise 40% 12000 ft	144 mph
Max range * 75% (solo/2 place)	1370/965 mi
Max range * 40% (solo/2 place)	2010/1430 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system

and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200
SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIA Continental	19.00	21.00
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order. Newsletter not taxable.		
TOTAL		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $3

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $2

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $2

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Sally Melvill taxiing out for first Long-EZ solo flight.

Long-EZ parked nose-down with two VariEzes.

The nose gear retracts for parking and in flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

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Long-EZ shortly after Dick and Jeanna arrived non-stop from San Francisco. **PHOTO OMITTED**

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THE CANARD PUSHER NO 27 JAN 81

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 27. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 27. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 27. If you are building a VariEze from 2nd Edition plans you must have newsletter 16 through 27. If you are building a Long-EZ from 1st Edition plans you must have newsletter 24 through 27.

A Current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave CA., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins.

Saturday Demos - Every Saturday (except when gone to airshows) RAF conducts a demo at our shop at the Mojave Airport. We start the presentation/discussion at 10 am each Saturday with flight demos of our experimental aircraft at approximately noon (weather permitting).

Bring any of your parts for inspection. We are located near the west end of the flight line at the Mojave Airport about 2 hours drive north of Los Angeles on Highway 14. When arriving at Mojave by car turn east at the Carls Jr restaurant to find the airport.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed your reply.

Mike and Sally's Long-EZ by Mike.
In CP 26 Sally and I were going at it as hard as we could to try to finish N26MS before the Bahamas Trip. Due to several circumstances,

some beyond our control, we were unable to fly our Long to the Bahamas, although we did manage to get a few flights on it prior to leaving on the trip.

We really burned the midnight oil the last few weeks and without help from Burt, Pat, Bruce and Giles, we would not have got it flying before leaving. We filled and primed all the parts and then transported it down to Mojave Airport, where we finished up engine baffling and wiring. On Sunday, 21 December we finally had it all done. We put 10 gallons in each fuel tank, flushed the fuel system thoroughly and started the engine. Since Sally and I overhauled the engine, it was a great relief to have it start and run so smoothly! We ran the engine for half an hour, then after conducting a careful weight and balance, determining that the cg was in the center of the first flight box for me, I taxied out for the first runway flights. I made 3 runs down the runway, checked brakes, rudder effectiveness, rotation speed and on the 3rd run lifted off a foot or two. It felt absolutely great, it was straight, no trim required, so I landed, taxied to the end of runway 12, and with Dick and Sally in Burt's Long-EZ on my right wing, I took off.

It felt absolutely right. It is a difficult moment to describe on paper, when you depart the runway environment completely, and commit yourself and your new airplane to the air, it is an incredible feeling. All engine instruments were in the "green", so I climbed on up to 5,000 feet and carefully explored various control inputs and power settings. I am delighted to report that it required no trim to fly straight and true. I flew about 40 minutes, landed and Sally made the next flight. She is also delighted with the handling qualities. Just before dusk Burt took it up and was pleased with it.

Since getting back from our Bahamas trip we have been putting hours on our Long. I have opened the envelope up to 185 knots indicated at 9,000 feet and she loops and rolls beautifully. The roll response is even better than the prototype N79RA. With no wheel pants, the large 500 x 5 tires and no spinner, speeds are not very meaningful, but at 7,500 feet she trues out at 151 knots (173mph), so I believe that with wheel pants, a spinner and a magneto that sparks on all 4 cylinders our Long-EZ will be at least equal to the owners manual, possibly a little better.

Evaluation of N26MS by Burt
Sally and Mike built this one with alot of attention to accuracy. The reward is an airplane that flys ball-centered at neutral roll trim, hands-off. Its roll qualities are crisp with minimal adverse yaw. Pitch handling is solid with firm speed stability. Stalls are optimum - a very mild pitch bobble at full aft stick. Roll reversals and sideslips performed at full aft stick are smooth and do not produce wing rocking. Engine noise and vibration are lower than the prototype due to the dynafocal mount. A superb flying airplane, the best of any type I've flown.
Back to Mike. - We will continue to report on how it goes, as we accumulate time and data.

Before final assembly we got a few more relevant weights:

Wings with ailerons and rudders complete

(before finish)	64 lbs. each
Rudders	
(filled and painted	1.2 lbs. each
Left elevator	
(filled and painted)	3.5 lbs.
Right elevator	
(filled and painted)	3.0 lbs.
Ailerons, with hinges,	
universal and torque tube,	
(filled and painted)	5.4 lbs. each
Canard with fairing cover	
(filled and painted)	18.5 lbs.
Canopy, with hinges	
(filled and painted)	17 lbs.
Wings with winglets, no rudders,	
no ailerons (filled and painted)	60 lbs. each

We ended up with a total of 1,200 hours. This included all man hours put in by everyone who worked on the airplane. This also includes overhauling the engine, developing the new engine mount and baffling, installation of such things as tape deck, intercom and what Burt calls "fru-fru" (non-essentials). See page 4 of this newsletter for Burt's comments.

CROSS COUNTRY IN A LONG-EZ by Mike Melvill

Due to our Long-EZ not having all the hours flown off in time for the Hospitality Club fly out to the Bahamas, Burt very kindly let Sally and I use N79RA. While I have quite a bit of flying time in Burt's Long, it has all been around the airport, this was my first long cross country in a Long-EZ.

To say that I was impressed would be putting it mildly., This is absolutely the nicest cross country flying machine I have ever flown. At 9,500 feet we trued out at 158 knots (183 mph) at approximately 72% power. At sea level, full throttle we trued out at 169 knots (194 mph).

We flew 3 legs of 5 hours and one of just over 6 hours. We were extremely comfortable at all times. Cabin noise level is a little high and a good noise-attenuating headset really is a must. The tremendous range is something I have not experienced before and there is a lot of comfort in knowing that you can fly for 7 or 8 hours if you have to, particularly in a bad weather situation. We generally had great flying

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weather, but on the way back Sally and I ran into about four hours of marginal VFR, low ceilings and occasional low visibility in rain. It was great to know that we could turn around or fly around virtually any sized weather system, without having a fuel problem. We flew in loose formation with Burt and Pat in the Defiant on part of the trip, and on one occasion we had to stop because the Defiant was getting low on fuel! Sally and I shared the flying almost equally and I was pleased to find how comfortable I was even in the back seat. I spent 17 1/2 hours there! On one leg, from Las Cruces, New Mexico to New Orleans,

Louisiana, a distance 1016 sm, the Defiant and Long-EZ went together non-stop at 9,500' and covered the distance in 5.1 hours, a ground speed of 199 mph! During this flight in smooth air several times, I did not touch the controls for an hour at a time, a super airplane. Total trip distance, including sight-seeing and demos was 6440 statute miles. All we did was add fuel and oil, no maintenance of any kind was required. N79RA how has 493 hours, averaging nearly 1 hour per day since first flight in June 1979.

CONTEST TIME!!!

We have had many requests for a Rutan Aircraft jacket patch, and of course we do not have such a thing. We will give a prize to the winner of the "Patch Design" competition, in the form of a New Mexican, laminated silver belt buckle, your choice of VariViggen, VariEze or Long-EZ on the buckle and a ride in Long-EZ here at RAF in Mojave. What we would like to see is a stylized or futuristic patch depicting Burt's canard type airplanes, or whatever you talented artist type builders can think of. Submit your ideas to RAF by March 30th 1981, and we will announce the winner in CP 28.

Peter Calvert of Leicester, England flying his VariEze, G-LASS, recently set two World records in Class C sub Class C-1-A.

1) Speed over a recognized course, Malta to London 145.05 km/h
2) Speed over a recognized course, Ajaccio to London 155.37 km/h

While the speeds may appear a little slow, Peter had to stop enroute twice for customs, fuel and the men's room, each stop of about 1 hour. Congratulations Peter.

Tom Garrison - Route "S" Box 80, Tulia, Texas, 79088 is trying to get a Long-EZ/VariEze group together in the Texas panhandle area. Any builders interested please contact Tom at the above address.

THE EZ BAHAMAS ADVENTURE - by Bruce and Bonnie Tifft

Island Hoppers:
Mule and Debbie Ferquson, Boomer, NC (Debbie flew commercially to the island, while Mule carted his guitar in the back seat of the EZ)
Ed and JoAnne Hamlin, Rocklin, CA
Jim Heitkotter and June Hartley, Fresno, CA
John and Mary Jackson, Jackson, MS
Byron McKean and Diane Meader, Seguin, TX
Mike and Sally Melvill, Tehachapi, CA
Dave Langston, Georgia and Jeff Rose, Chattanooga, TN
Norm Ross and Glenne Campbell, Victoria, BC, Canada
Burt Rutan and Pat Storch, Mojave, CA
Bruce and Bonnie Tifft, Ventura, CA
Earl and Barbara Wilson, Citrus Heights, CA

It is indeed a difficult task to attempt to relate the many wonderful experiences, feelings and thrills associated with this particular EZ adventure. However, we will try to recapture and share some of the highlights on the trip.

Our adventure started on the crisp, clear dawn of Saturday, December 20th. Anticipation and excitement filled us as we took off from Santa

Paula Airport, on a trip that we and others had been planning and scheduling for over a year. First stop - Las Cruces, NM and a warm and friendly reception from EZ Hospitality Club members Joan and Charles Richie. Super Mexican dinner at LaPosta (afraid the Richies were saturated with Mexican food by the time the other migrating EZs passed through). We were joined in Las Cruces by the Northern California contingent, Ed and JoAnne and Earl and Barbara (lo and behold, not another yellow EZ - beautiful). This was Earl and Barbara's first trip after frantically getting their plane signed off in time for the journey. Ed did the navigating and led the way allowing Earl to concentrate on flying his shining new bird.

Next stop - - - New Braunfels, Texas. As we open the canopy we hear Christmas music over the loudspeaker and a grinning "real live" Santa Claus, alias Byron McKean, welcomes us. They don't exaggerate when they talk of Texas hospitality. It was great!

We again join up with the Hamlins and Wilsons in historical New Orleans on Christmas Eve. With the gracious assistance of Club member, Dewey Straley we enjoyed a delicious Cajun dinner at Berdous Restaurant and then real "southern comfort" at the Straley home. A gathering of EZs took place Christmas Day as Byron and Diane arrived at Lakefront Airport. Shortly after, the Louisiana sky was filled with the roar of the arriving Defiant and Long (Burt, Pat, Roger, Mike and Sally). Christmas evening was spent taking in the intoxicating atmosphere of the French Quarter with some fantastic jazz at Preservation Hall and then on to Pat O'Brien's for a roaring good time.

Burt, Pat and Roger, desiring some over-the-water experience, navigated the Gulf of Boca Raton. The rest of us, having only one engine, meandered in groups along the coastline to Ft. Pierce, Florida. Our timing was incredible because as we were flying over Ocala, Florida, we happened to catch the Southern contingent grouping there (the Jacksons, Mule, Dave and Jeff).

St.Lucie County Airport was bustling with EZs from all over the country as we arrived (by the way, Sally was front-seat pilot of the Long on this leg of the journey). Many of the local Club members were there to welcome the group. Our Bahamas Tourist host, Marshall Dent, was also on hand to haul us all to the Holiday Inn. (At this point, we must extend our very special thanks to Norm and Gertrude Dovey for rescuing the "BEEZ"). After an excellent steak dinner and a round of introductions, pilots and crew tackled the job of getting 9 EZs, 1 Long and 1 Defiant across the Atlantic to Andros Island. After a great deal of discussion (can you imagine all these "individualistic" individuals trying to come to a single solution!) it was decided to have three separate flying groups. The Defiant would lead the way and check weather, etc., and report to the others. Radio channel 123.4 was filled with chatter between the Blue, Yellow and Red flight groups. It was an incredibly beautiful flight and all three groups successfully invaded the sleepy island of Andros (no one had to test the "floatability" of their plane).

Although the clouds hid the sun from the island for the first few days, the group jumped in with both feet and went native. Perhaps the following will give you a few glimpses of the activities;

Norm, Glenne, Bruce and Bonnie bicycling in the rain.
Pat and Sally not able to resist the temptation to swim in the aquamarine water in their undies. (Sorry for squealing on ya' ladies).
Barbara sitting in the "Yellow Tuff" at Ft. Pierce making sure, at long last, that she made it to the Bahamas.
Ed trying to calm JoAnne down after she was greeted by a big green frog in her bathroom.
John trying to talk someone into playing doubles tennis so he didn't have to face Mary alone.

Mike, Burt and Norm in one very small sailboat going out to the reef for some fantastic snorkeling.
June and Jim bicycling a very long distance and being rescued by a friendly van driver who hauled them and bicycles back to the hotel.
Byron jogging down the runway in the early dawn accompanied at various times by Jeff, Burt or Bruce (where were you, Diane?).
Mule entertaining the entire hotel with his guitar medleys. Of course, everyone joined in the singing including Maurice (a friendly gent from Montreal) who sang the old hillbilly tunes in French.
The whole "nutty" group building a 6 place sand EZ on the beach, conch shells for strobes, whiskey bottle for pilot tube?
Dave diving for conch shells and conning Mule into hauling them back for him.
John and Jeff taking a "walk" by the "topless" girls on the beach.
22 nuts in one van coming back from the beach.
The group terrorizing the poor controllers at Nassau International Airport who kept insisting that we where all Defiants or referring to us as "small jets".

The group departed at different time intervals and started winging their way homeward. It was indeed a wonderful adventure; one I am sure we will all remember and cherish for a long time. The thrill of flying the planes across the United States, combined with the friendship and fellowship of the Club members and people along the way, made for a holiday that will be very hard to top! To answer the question everyone was asking, "WHERE TO NEXT?" Our reply, we haven't the foggiest notion. ANY SUGGESTIONS??

For Norm Ross and Glenne Campbell, with their 1979 Oshkosh Grand Champion VariEze, Bahamas was just a jumping off point on a more extensive trip. Pegasus, based in British Columbia, was going on the longest trip yet flown by a VariEze. Traveling is not new to Pegasus, having flown 420 hours (70,000 miles) in the 17 months since Oshkosh '79. The following is Glenne and Norm's story:

Bahamas Adventure follow up -
Just hours before press time Norm and I have arrived in Mojave to catch Bonnie's report on the EZ Bahamas Adventure. As a follow up to her quest 'where to next' we'll report a sampling of what goes on further south.

Pegasus and crew departed Andros Island and Eze people accompanied by Mike and Sally as send off party. We flew down the colorful cays to Exumas Island, landed, dined, refueled and shared fond farewells. As

Mike and Sally 'rolled out' I held my breath and maintained (?) disbelief in the safety in numbers theory. Norm and I caught a ride into Georgetown, the village haven of royalty from all over the world. Truly a beautiful location with a variety of affordability and activity.

Onward the following day we flew down the cays, refueled at Great Inauga, and onto Port au Prince, Haiti. To our surprise the Haitians speak very good French, a lot of Creole and some English. There we refueled and climbed out to make our journey high above the clouds to Kingston, Jamaica. No worry of flying over the water this leg of the journey as the cloud cover was so thick nothing below was visible. The tell tale sign of land was a square inch of mountain peak off in the distance. Norm's navigation brought us right out over the top of Kingston where the clouds cleared for eze access. Jamaica was interesting. We had to pay a dollar each to ride in a van with 20 others to town. General aviators are not warmly received in Jamaica. Landing fees are twenty dollars, you must clear health and pest control (the aircraft is sprayed) as well as security, immigration, and customs - all very time consuming. All flights in Jamaica require inward and outward declaration, flight route clearance, and customs clearance. We were not allowed to fly to and land at the town we had plans to meet friends at so had to leave the plane at Montego Bay where security was assured but left us 'uneze'. We travelled 50 miles by taxi in the dark to Negril on the west end of the island. Accommodations there are plentiful but must be sought out as the natives rent rooms and camping space. The head of every Jamaican family will tell you that Jamaica is a place to "cool the brain", but don't plan on doing it in the cool of the evening as every family has an assortment of at least five skinny dogs to act as doorbells, night watchmen and alarm systems from sundown to sunup.

Needing a rest, we returned to MoBay, cleared customs, recovered our wings and departed for the return stretch of our journey. Back in Haiti we stayed overnight in a motel "on the hill" where we met numerous people from around the world, each in the country for a different purpose. It was there someone suggested we visit Santo Domingo on the south cost of the Dominican Republic. We flew there via Cap Haitian, Haiti, where the eighth wonder of the world sit perched upon a mountain top as the citidel built to protect the natives from reinvasion of the French many moons ago.

Santo Domingo is the location of Christopher Columbus's discovery of the western world. We landed at Las Americas airport, here most (excluding American Airlines employees) speak Spanish. Fortunately a young fellow befriended us and assisted us through customs etc.

Unfortunately we felt the need to return to the continent so didn't spend time in the city which looks to be very interesting historically and culturally.

Our return flight took us Santo Domingo - Great Inauga - Fort Pierce - an so far Mojave. Many thanks to Norm and Gert Dovey, Jack and Marilyn Day and Harry and Donna Bush for their fine hospitality. By the time we touch down home at Victoria B.C. we will have covered 11,000 miles and as Bonnie says "Where to next?" Any suggestions??

Tips for Caribbean travellers:
- inward and outward general declarations are required by each country. These are available from AOPA.
- file flight plans, keep tanks full of fuel.
- have a good communications radio
- VORs are few and far between
- speak some French and Spanish
- carry a good Caribbean guide, such as Fodors.

Best wishes, Norm Ross and Glenne Campbell.

International VariEze Hospitality Club Fly-in

Organizer: Charles and Joan Richey,
(505) 523-1300
Camping and Condo's in Alpine Ski Valley
Cookout planned.
4th and 5th July 1981.
Taos Ski Valley, New Mexico, fly in to Taos Airport.

NACA FLUSH INLET

Steve Woods and Tim Gheres (address: Wood & Gheres Inc. 105 Appleblossom Court, Orlando, FL 32807) are selling plans and providing builder support for those builders installing flush inlets. (see CP #26).

Mike installed one on his Long-EZ and used a 12 inch wide inlet, rather than the 14 inch size suggested for the 0-235. His 0-235 runs cool. We recommend using the 12 inch configuration for the 0-235 Lycoming. Mike also installed an access panel aft of the main gear strut in the "top" (bottom?) of his NACA duct. This panel is an oval shape, 5" x 10" and is constructed and installed using the same method shown on page 13-11 for the nose door. This allows inspection of main gear attachment and access to plumbing and wiring normally only accessible through the hole in the back seat bulkhead. This same panel can also be installed on a Long-EZ (or VariEze) without the NACA inlet, in the same place. Do not make the entire area removable this cover area is required for structural reasons and should not be omitted.

Plans for Installation of Lycoming Engines in Long-EZ

As many of you know, we have not had a Lycoming engine section available since June. Section IIC was written in 1977 by an outfit on the east coast who first developed the Lycoming VariEze installation. We found many fit-related problems with this section when we used it to install the engine on the Long-EZ prototype, N79RA. Also, the Long has a number of major changes involving the fuel system, exhaust system, baffles, dynafocal mount and carb controls. Since it was evident that major changes were needed and that some of them would have to be flight tested, we decided last June to use Mike's Long-EZ to check the changes and to hold up printing the new plans until every detail had been flight tested.

Presently, Mike's engine is being fitted with EGT and CHT probes on all four cylinders to check inlet distribution. By the time you read this all testing will probably be complete. Because of the extent of the revisions, we will be publishing an entirely new section, Section IIL, for Lycoming. Section IIL will be available in early February 1981. As soon as it is received from the printer it will be mailed to those who have a Section IIC on back order.

Some of you Long-EZ builders have purchased, and received a Section IIC before the supply ran out last June. Do not use IIC to install your Lycoming in a Long-EZ. Return your IIC to us, we will replace it with a new IIL at no charge.

IMPORTANT WEIGHT INFORMATION - LONG-EZ

The most disappointing thing about the VariEze experience has been the general lack of adequate weight control by most builders. It is necessary to use diligence in controlling and eliminating each gram in order to avoid an undetected growth of many pounds. It is a reliable prediction the many Long-EZs will be built over-weight and be limited to short range or single-place operation. An equally reliable prediction is that many Long-EZs will be built with little equipment, careful weight control, and will be considerably lighter than those now flying. They will enjoy a high useful load, great takeoff and climb performance and unexcelled range.

The following information is a complete analysis of the actual weight of Mike and Sally's Long, N26MS. If you are building a Long, it is very important that you study all this information before you plan your equipment installation that you be aware of the weight impact of any additional equipment. N26MS has excellent structural workmanship, thus, most airplanes with less attention to good layups will probably be heavier than the data shown below. Study the table below. Note particularly the magnitude of the additional equipment.

N26MS was built with two conflicting requirements that added considerably to its empty weight: (a) full electric start with large alternator, and (b) pilot weight of only 108 lbs. using no temporary ballast. While the heavy electric (number 4) and ballast provisions (number 7) had the major impact on their heavy final empty weight of 883 lbs., their utility has not suffered as much as one might think. The reason is the total weight of Mike and Sally is only 263 lbs.. Thus, using the 1425 gross (owners manual page 30) their allowable fuel load is 46.5 gallons giving 1,000 mile range at 75% or 1,550 miles at 40% power, with reserves. Their allowable fuel load at normal gross is 29.8 gallons. Consider this same airplane with two 190 lb. adults as crew and without the then unrequired number 7 ballast provisions. That situation leaves only 207 lbs. (34.5 gallons) fuel for a range at 75% of only 700 miles, with reserves, or 350 miles with a 1325 lb. take off. Obviously, with that 360 lb. crew weight strong consideration should be given to using the electrical system in number 2 and eliminating as many items as possible in number 6, and 8, to provide the high utility and long range available with the Long-EZ.

We encourage everyone to use the light electrical system as in number 2. This is the one installed in the RAF prototype N79RA. Then, add

only the equipment you absolutely need and diligently refrain from seemingly - "small" additions.

Note that it is possible and advisable to have the Nav, Com and transponder with the small alternator and have an empty weight of less than 720 lb. However, if your front-seat pilot weight is less than 170 lb., you should use the 25 AH battery in the nose and accept the 19 lb. increase. This will be needed anyway to balance the aircraft. Also, if you are a very light pilot (less than 150 lb), be prepared to suffer a large penalty in empty weight if you want to install an electric starter. The starter, ring gear, alternator, brackets etc. mount way back at station 150+ and will require nose ballast for light pilots.

If you are successful in obtaining an empty weight of less than 730 lb you can fly two 180 lb people with the full 52 gallons of fuel and attain over 1800 nautical miles (2070 sm) range at economy cruise - a feat considerably in excess of any other light aircraft.

LONG-EZ EMPTY WEIGHTS BASED ON N26MS

1.	BASIC EMPTY WEIGHT (BEW) VFR instruments plus g meter and turn/bank gyro. No starter and alternator, graphite cowling. All equipment and components per plans. Conical engine mount and ram inlet. No avionics, cabin heat or lights. Small motorcycle battery to power warning system and fuel pump.	693.4	lbs.
2.	BEW plus the small alternator (see CP 26), including wiring and regulator (4.9 lbs.).	698.3	lbs.
3.	Number 2 plus Com, Nav, Transponder and all installation misc. (15.4 lbs.).	713.7	lbs.
4.	BEW plus standard 60-amp alternator, starter, ring gear, belt, brackets, mounting hardware, regulator, wiring, relays and 25 AH battery (68.5 lbs.).	761.9	lbs.
5.	Number 4 plus Com, Nav, Transponder and all installation misc. (15.4 lbs.).	777.3	lbs.
6.	Number 5 plus additional equipment on N26MS including: 500 x 5 tires, dynafocal mount, NACA inlet, landing light, Nav lights, strobe lights, cabin heat, relief tubes, primer, intercom and stereo tape player (38.1 lbs.).	815.4	lbs.
7.	Number 6 plus provisions to allow Sally (108 lb. pilot) to fly at cg=102.2 (1.8" fwd of aft limit). Includes a second 25 AH battery, wiring and switches to use the second battery, and 15 lbs. of lead permanently installed in front of NG 31 Bulkhead (44.8 lbs.).	860.2	lbs.

8. Number 7 plus some extras added because they were nice and "didn't hardly weigh anything". Misc. ranging from small covers and aluminum knobs, to heavier upholstery and different fuel caps (12 "small" items 22.8 lbs.). 883 lbs.

Advanced Composite Lightweight Cowling.

Graphite (carbon-fiber)-reinforced cowlings for the Lycoming Long-EZ will soon be produced and available through Aircraft Spruce and Wicks. Differences between these and the standard cowl are shown below.

	Standard	Graphite
Materials:	Gel coat Glass Mat/cloth Polyester resin	Glass Cloth Graphite Cloth Epoxy
Weight:	18 lb	12 lb
Cost: (both halves)	Approx. $245	Approx. $360

We have tested a prototype of this graphite cowl and are pleased with it. The part numbers are as follows for all cowls, standard and graphite.

Part #	Materials	Aircraft	Engine	Top/Bot
CCT	Glass	VariEze/Long	Cont	T
CCB	Glass	VariEze/Long	Cont	B
LCT	Glass	VariEze	Lyc	T
LCB	Glass	VariEze	Lyc	B
LCT-L	Glass	Long-EZ	Lyc	T
LCT-LGrap	Graphite	Long-EZ	Lyc	T
LCB-LGrap	Graphite	Long-EZ	Lyc	B
LCT-Grap	Graphite	VariEze	Lyc	T
LCB-Grap	Graphite	VariEze	Lyc	B
LCB-L	Glass	Long-EZ	Lyc	B

Continental O-200 Engine for Long-EZ?

As you have read in recent CP newsletters we are strongly recommending the Lycoming over the Continental for the Long-EZ. This is not to say the O-200 will not work - its installation is well-tested in VariEze airframes and, with the addition of mechanical fuel pump should operate well. However, with the O-200 you may find it a difficult and expensive modification to adapt an approved mechanical pump. Also, you will not be taking advantage of our recent development effort the last six months in refining and flight testing all the components in the Lycoming installation (Section IIL). If you have an O-200 you might consider trading it up for an O-235. O-200's are bringing an excellent price now days.

FIBERGLASS LAYUPS

We have recently inspected some layups with unacceptable epoxy-to-glass ratios and improper fiber orientation. Aircraft structure, whether its fiberglass, aluminum, or welded steel must be built properly or must be rejected. It is not satisfactory to accept any critical part that has excess epoxy. On every part, be sure to do the squeegee test for a "ridge" - see page 3-11 step 7. Pull the squeegee along, stop and remove it and see if you have piled the excess epoxy up into a ridge. You must spend time with the squeegee pulling all excess off the sides if the test reveals a ridge. Do not attempt any layup (except small corner tapes) unless you have a clean, flexible, smooth squeegee to use. It is not possible to smoothly remove excess or determine correct ratio with a brush. When building any type of aircraft structure, your very best workmanship is just barely adequate. Do not accept anything less. Practice on your Chapter 3 flat layups until it is perfect before building aircraft parts. If in doubt on how a given layup should look, duplicate it on a small piece and send it to RAF for our comment. It is difficult to access the acceptability or dry or wet layups on the phone.

BUILDER HINTS - LONG-EZ AND VARIEZE

Do not use peel ply over the entire structure. This starves epoxy from lower foam surface, makes inspection difficult, gives an erroneous impression of good surface smoothness, makes it easy to unknowingly damage structure during finishing and adds weight. For example - if the elevators are peel-plied they will be too heavy to balance and must be discarded. Do peel ply surface edges of glass plys whenever they exist and, of course, whenever a layup will be later made over a cured surface.

Cockpit Paint - We have received a number of questions regarding ultraviolet protection of the glass structure inside the cockpit. Cockpit structure, like the external structure should never be exposed to direct sunlight without the protection of a suitable ultra violet barrier. A well maintained coat of color paint is adequate, but it is desirable to use primer over the fiberglass surface. Dupont type 70S provides the best UV barrier (high content of carbon-black), however type 100S will result in better adhesion to enamel paints. Mike and Sally used a Standard Paints product, called "Zoletone", Charcoal Gray in their cockpit. This material gives a beautiful spackle-type finish that hides minor irregularities and the glass cloth weave. This paint was sprayed directly on to the glass interior, after scuff sanding with no filling at 70 lbs. per square inch pressure.

Engine mount and mount extrusions - The older conical-type engine mount had tubes that were flexible enough to accommodate minor variances in the positioning of the aluminum angle extrusions in the fuselage. The new mount designed for the Lycoming dynafocal configuration has extra supports and is very rigid. Extreme care was taken to make the Brock welded mount accurate, to fit the extrusions, however normal tolerances may preclude a good fit on all airplanes. Thus, we are recommending the following method to assure an acceptable fit: Before allowing the extrusions to cure in place in the fuselage, clamp the welded mount to them. Shim with additional plies of BID if needed on the fuselage and centersection spar. Let the extrusions cure with the welded mount clamped in place.

Hot wire troughs - Use the following method to separately cut the troughs. This gives more accurate, sharper cuts. Nail a temporary template (a popsicle stick works fine) to guide the wire straight across over the trough. Then, remove the stick, and in a separate pass, cut the trough. Be careful to not let your core move between the cuts. **SKETCH OMITTED**

Drill a sight hole through all control push rods in order to verify that you have the rod ends screwed in with sufficient threads into the push rods. This hole should be 1/16" diameter, located at 0.4" from the end of the push rod. **SKETCH OMITTED**

Page 9-3, Long-EZ plans, a small 1/8" o.d. brass tube 1/2" long is called out to be used in the end of the Nylaflow brake line. In some cases the little brass tube will slip up into the Nylaflow tube, and be difficult to extract. This problem can easily be overcome by using a Weatherhead tube, part #2030X4. This little tube has a flange on it and it works great. If you cannot obtain it locally, Aircraft Spruce has them.

CP27, page 5

Wiring the Rochester fuel pressure gauge.
Mike used Rochester gauges on his Long and they work well. The oil pressure and oil temp. gauges were straight forward to wire. However the fuel pressure gauge is a little different and some builders may not have received a wiring diagram. **SKETCH OMITTED**

We put a Marvel Shevler MA3-spa carburetor on N79RA without a primer system and since have accumulated over 350 hours on the airplane. The MA3-spa carb has a built in accelerator pump which really makes starting the engine a lot easier, particularly in cold weather. If you plan on operating your 0-235 Lycoming in cold climates, an accelerator pump or primer should be considered almost mandatory.

After you have installed your ailerons, check to be sure you have a minimum of 0.1" gap between the aileron leading edge and the bottom skin of the wing. This is necessary for protection from ice freezing the aileron to the wing. This can happen even in VMC conditions, if the wing is wet and you climb above freezing level so do be certain to comply with this.

Long-EZ builder hints.

Heavy Unidirectional Fiberglass Tape - The 3" wide roll of unidirectional glass is used only for the spar caps of the wing and centersection spar. "BID tapes" called out are cut from BID cloth (generally 45 degree orientation). Other UND pieces or strips are cut from UND cloth. Be sure fiber orientation is correct.

The canard inserts (page 10-2) should be drilled to match the hole pattern of CLT (page 10-3). These inserts (CLI) are available from Brock. Brock is also stocking the NG5 plate (page 13-3).
Note: The raw materials list does not include the 1/8" aluminum for these parts.

Aft fuselage side shape. A number of builders have noted that the A-5 drawing has a different shape the that obtained when fabricating the fuselage sides per the page 5-1 dimensions. This approximately 0.2" error will not present a problem if you follow these instructions: Carefully follow all the dimensions on page 5-1. This will assure that the firewall will fit. Do use the 5.8 and 6.9 dimensions on A-5 and be sure the extrusions are perpendicular to the top longeron. Ignore the small difference between the bottom shape and that on A-5.

Long-EZ Cowl and Canopy fitting.
As will be shown in the new Long-EZ Lycoming engine installation section (IIL), the Lycoming cowl has been moved aft 0.7" from where it was in a VariEze. This was done to provide better clearances. With the new dynafocal engine mount, the engine is moved aft also, to provide good magneto clearances and an acceptable structural arrangement for the mount tubes. The new Section IIL will show you how to fill the cowl-firewall gap when mounting the cowl using the method used on N79RA and on Mike and Sally's Long. Cowling manufactured for Long-EZs after December 20, 1980 have the lip extended to allow easier installation. These cowlings can be identified by checking the dimension shown below.

SKETCH OMITTED

(OLD COWL=32.0)
(NEW COWL=32.7)

This cowling move has resulted in a miss-match of cowl-to-firewall at the top of about 0.2". Mike faired the miss-match in with dry micro, since he had already fabricated the canopy aft cover piece (Chapter 18). To avoid this micro fill, we suggest that you: Trial fit your cowling to the firewall before carving your canopy aft cover piece. If you have not cut out your firewall, make it taller at the top and trim to fit your cowl during Chapter 18. (see LCP #48).

VariEze builder hints.

Under the thigh support, in the front seat on the right side, there will be a gap under the right console, which could possibly allow a small object stored under the thigh support to slip under the console into the area near the pitch control belcrank. This "gap" should be closed off. 1 ply of BID will do it.

We have talked to several builders lately building from 2nd Edition of the plans who have not been reading Chapter 26 (plans updates). Do update your plans with Chapter 26 and all applicable newsletters before continuing construction.

ACCIDENTS

The CP Newsletter reports accidents and discussed their conditions and causes for information purposes for all operators. We have always investigated accidents in the interest of determining information that we can disseminate to you to prevent recurrence. It should be recognized in our discussion of accident conditions or causes that

generally this information is preliminary since it is published before the availability of the FAA accident report.

A Tennessee VariEze crashed, fatally injuring the pilot and passenger. The aircraft was observed making a low pass by his house when the aircraft hit a tree and crashed. The pilot had a reputation for this type of flying and had been warned by others in the past but to no avail. The accident was late in the afternoon and the fact that the pull out from a steep dive was into the sun could have been a factor in the pilot's inability to judge the pull out angle. No malfunction of any part of the aircraft could be found. This flight was clearly in violation of FAR minimum altitude criteria.

PLANS CHANGES

We at RAF, or course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas, FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify this aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LONG-EZ PLANS CHANGES

LPC #42 OPT Page 4-2

Add "alternate the BID and UND plies that reinforce the sides of the forward face of F-22". Note: Modification is not required if you have already installed these without alternating.

LPC #43 MEO Page 18-7
Lower right "to firewall bulkhead" should be "to aft end of canopy frame FS 117" (two places). See page 18-5.

LPC #44 MEO Page 10-1 Step 1 paragraph two
Refers to two 7 x 14 x 41 blocks (two places), change this to one block.

LPC #45 OPT Page 9-3
Move the 3/8" holes in all four extrusions up 0.4". Also modify outlines to maintain original edge distances around the 3/8" hole. This moves the entire main gear up 0.4", resulting in an improved gear-fuselage juncture reducing aerodynamic drag.

LPC #46 OPT
Revise F28 bulkhead by moving the longeron notch down 0.25". This raises F28, for better fit to canopy.

LPC #47 DES
Due to a probable rubbing of the rudder cable on the aileron pushrod, the left hand rudder pulley bracket should be moved up 0.6". If you have already mounted the 3 bolts in the firewall such that you cannot make this change, you can provide cable clearance by carefully bending the rudder pulley bracket to move the pulley aft approximately 0.2". Bend as shown below. **SKETCH OMITTED**

LPC #48 DES, Firewall, page A4
Increase size of firewall at top as shown to assure adequate height to fit cowling. **SKETCH OMITTED**

LPC #49 MEO Page 22-6
On circuit breakers, change "roll trim" to "fuel pump".

LPC #50 MEO Page 7-1
Section A-A. This sketch is not accurate. See page A2 for the correct full size drawing. Also note LPC #46 in this CP.

LPC #51 MEO Page 10-1, Step 1
Refers to Chapter 13 for winglets, should be Chapter 20.

LPC #52 MEO Page 8-1
Roll over structure assembly 4.5" should be 4.0", moving shoulder harness insert outboard 1/2".

LPC #53 MEO Page 2-1
Add CLI and NG5 to Brock list.

EZ CALC

The development of the fuel flow calculator is still underway but delayed somewhat due to parts availability. We expect to be testing a mock up unit in our airplane this month. We will also evaluate a new turbine fuel flow transducer in a gravity flow system to determine if

it can be used in a standard VariEze. The dimensions are 3" x 6" x 1.5" mounted vertical and the unit will be detachable or can be flush mounted. See CP #24-7 and 26-6 for more complete details.

More foam substitutes - CP #26 listed a high density (18 lbs. per cubic foot) white urethane foam as an allowable substitute for the 16 lbs per cubic foot R250 PV foam previously listed for the VariEze and Long-EZ. We are now listing a medium-density Clark white urethane foam as an allowable substitute for the 6 lbs. per cubic foot PV R100 (light red) foam. See the table below. The distributors may be suppling either type for a temporary period. We have no plans for any substitution of the PV R45 dark blue foam in the Long-EZ list. Its superior peel strength and damage resistance justify its higher cost.

VariEze
Old Specifications
R100 6 lbs. per cubic foot (light red)
2 pcs. - 90cm x 80cm x 9mm
New allowable substitute
6 lbs. per cubic foot Clark (white)
3 pc. - 3/8" x 24" x 48"

Old Specifications
6 lbs. per cubic foot (light red)
2 pcs. - 90cm x 30cm x 9mm
New allowable substitute
6 lbs. per cubic foot Clark (white)
1 pc. - 3/8" x 24" x 48"

Old Specifications
6 lbs. per cubic foot (light red)
1 pc. - 15cm x 27cm x 25mm
New allowable substitute
6 lbs. per cubic foot Clark (white)
1 pc. - 1" x 6" x 12"

Long-EZ
Old Specifications
R100 6 lbs. per cubic foot (light red)
1 pc. - 1" x 6" x 10"
New allowable substitute
6 lbs. per cubic foot Clark (white)
1 pc. - 1" x 6" x 12"

Old Specifications
6 lbs. per cubic foot R100 (light red)
2pcs. - 0.25" x 35" x 44"
New allowable substitute
6 lbs. per cubic foot Clark (white)
3 pcs. - 1/4" x 24" x 48"

SHOPPING

Aircraft Spruce and Wicks stock a safety kit which includes:

50 gloves
1 pair goggles
12 dust masks
1 can hand cleaner.

The kit costs approximately $25.00 and we have found them to be most useful.

Aircraft Spruce would like to request that overseas customers order all finishing materials that they may require (featherfill, primer, surfacer etc.) with their initial order, so that all of it may be shipped by surface vessel. Flammable materials cannot be shipped by air due to regulations. So if you wait until you need finishing materials, you will not be able to get them very quickly, as they will have to go by surface vessel.

Both Aircraft Spruce and Wicks will have the 3.40 x 5 wheel pants in stock in February. These are suitable for both VariEze and Long-EZ. They will also be stocking wheel pants for 500 x 5 tires (Long-EZ). Contact them for expected date.

Ken Brock Manufacturing catalogs are $3.00 and this is not refundable with an order. Catalogs cannot be sent out C.O.D.

Ken Brock is now manufacturing the heavy 1/4" aluminum main gear mounting extrusions. They incorporate the 0.4" move (plans change #45) and also have 1/2" diameter flanged steel inserts for improved durability. Part numbers are - Aft: LMGB-RA and LMGB-LA, Fwd: LMGB-RF and LMGB-LF. The forward parts are supplied without the large lightening holes, so VariEze builders can saw off the top 1" to install a Long-EZ gear on a VariEze.

PRICE INCREASE ON GEAR.

Due to increases in materials and labor costs we are having to increase the price of the S-glass parts. Effective 1 February 1981 the new prices are:

NG-1 $309.00
MG-1 $ 55.55

Backlog on these parts is approximately 9 weeks. Main gear are shipped Greyhound, freight collect. Nose gear are shipped UPS. Please be sure to include your phone number with orders.

Video tape of Moldless Composite Construction

RAF had a crude preliminary version of an educational video tape on glass/foam construction at the booth last year at Oshkosh. Many have asked for copies of the tape when it has been shown at our weekly Saturday demonstrations. We have investigated the cost of producing an improved version for sale in the 1/2" home video formats of VHS and Beta II. We currently plan to have the tapes available by late February, contact us at that time for prices.

VARIVIGGEN NEWS

Wayne Wilkins reports good progress on his Viggen 12VV. He sent in a bunch of photos and has his main gear and nose gear installed per N27MS, and is happy with it. It looks excellent in the photos. Wayne's Viggen is skinned on the bottom and is on the gear.

Ken Winter, Tulsa OK. is working on composite SP outboard wings. Inboard section is basically complete. Ken may be the next Viggen to fly.

Orvill Winfield also has the N27MS main and nose gear and his looks great in the photos. His Viggen is upside down on saw horses and he is skinning the bottom.

Arthur Schwartz' Viggen now has 16 hours on it and Arthur is very pleased with it. The problems we reported in CP 26 page 9, have been corrected and Arthur reports that his Viggen is hands off now and he really is enthusiastic about it. N27MS is flown here at Mojave about every Saturday but since returning from Oshkosh, has not been on any trips, she now has 480 hours.

RAF MODEL 58 PREDATOR UNVEILED

We are using this newsletter to announce a development program that has been underway at RAF since late 1978 on a new agricultural aircraft. The design came out of a feasibility study done by RAF for Mr. David Record. The requirement was for an efficient, high-capacity aircraft using the PT-6-34 turboprop engine. The span had to be long for maximum swath width. Stall/spin resistance, visibility and pilot crash protection were also prime considerations.

After evaluating several configurations, a connected-tandem wing arrangement was judged best for the requirement. This arrangement allows a long span and provides low induced drag. The chemical hopper at the cg does not interfere with wing structure. The pilot's position in the large vertical fin allows improved protection and visibility. The elevators, on the inboard forward wing provide pitch and 'direct-lift' control for improved ground-proximity flying qualities. Differential ailerons on the outboard wing provide roll and proverse yaw without a pitch trim change. There are no controls on the aft wing. The inclined bracing of the wings allows an extreme span without excessive structural weight.

The RAF Model 58 will have satisfactory climb performance at its gross weight of 12,300 lbs. (6,700 lbs. in the hopper) in a 1.5-g turn. Current ag aircraft using the same engine have marginal turn performance using only 4,200 lb. payloads. Maximum L/D for the Predator is over twice that of current ag aircraft. Combining advantages of payload, speed, swath width, turn performance, ferry speed and fuel flow, results in a productivity of greater than twice that of current ag aircraft.

The concept of joining tandem wings is not a new one. It was originated in the 20's by Norman Warren and Rex Young of England. Wind tunnel tests were later done by Darroll Stinton and Warren using the concepts earlier proposed. More recently, Dr. Julian Wolkovitch, an aerodynamist from California, used joined wings on a recreational glider prototype. He has proposed several configurations of wing

joining, to make maximum use of the structural benefits of the bracing achieved with large dihedral angles. The Rutan-designed Predator Model 58 has undergone extensive wind-tunnel tests conducted by NASA's dynamic stability branch at Langley, VA. Those test are directed by Joe Chambers and Joe Johnson who have had the foresight to keep alive an aging 12 foot wind tunnel to investigate many interesting aerodynamic theories and configurations. The wind-tunnel test (see photos elsewhere in this newsletter) program has solved several stability deficiencies and confirmed the performance of the Predator configuration.

Details of the development plans for Predator cannot be released at this time. When an announcement can be made it will be in the Canard Pusher.

IMPORTANT! WRITE RAF IF YOU HAVE A RAF-DESIGN FLYING

The following paragraph was printed in CP #25, but we have had a poor turnout of letters from the owners. This list and the CP newsletter is our only means of notification of safety bulletins. If you have an airplane that has flown, please scan the list below then drop us a card or letter with the needed information. Also, if you have not already done so, please send a photo of your aircraft to the Historian of the International VariEze Hospitality Club, Irene Rutan, 8526 Calmada, Whittier, CA 90605.

RAF maintains a list of completed EZ's so we can contact you direct in the event of a flight-safety-related problem requiring an emergency directive. This list is also beneficial to access statistical items relating to structural and systems reliability. The list is, of course, kept in confidence. A printout of registration numbers is shown below. We believe there are about 100 flying VariEzes that are not on our current list. If you have an EZ flying please scan this list to find your number. If you are on the list please write RAF and tell us the date of first flight and the current total flight hours. If you are not on the list please write and supply:

1. Type - (Long-EZ, VariEze, VariViggen)
2. Name of Owner
3. Address
4. Date of first flight
5. Registration number (N-number)
6. Total hours

1	N9283A	54	N899EZ	107	N34RD	160	N21LB
2	N78LM	55	N78248	108	N12CN	161	N2UN
3	N83DL	56	N36EZ	109	N48EZ	162	N25RH
4	N6SB	57	N711QB	110	N77EJ	163	N13EZ
5	N1WX	58	N35EZ	111	N4985Z	164	N60EZ
6	N999EZ	59	N4WH	112	N808CM	165	N9608A
7	N51975	60	N15LL	113	N77LF	166	N78JK
8	N78EZ	61	N216EZ	114	N666EZ	167	N322EZ
9	N747U	62	N124G	115	N3VE	168	VHEZK
10	N9HR	63	N9783A	116	N67EZ	169	N9RC
11	N?	64	N300EZ	117	N77ODY	170	N500EZ

Canard Pushers from 1 to 82

12	N4CM	65	N37913	118	N50RW	171	N115EZ
13	N7WC	66	N84ST	119	N837	172	N51820
14	N91CL	67	N?	120	N295EZ	173	N139EZ
15	N16BG	68	N9113A	121	N76WJ	174	N222SK
16	N7EJ	69	N13CF	122	N39EZ	175	N37EZ
17	N747TC	70	N95BC	123	N34MB	176	N89EZ
18	N65H	71	N253EH	124	N4ZZ	177	N98EZ
19	N5021Y	72	N7ER	125	N66EZ	178	CGHYP
20	N22802	73	N123EZ	126	N?	179	N2VE
21	N78SP	74	N34RD	127	N27CP	180	N36SD
22	N2NP	75	N9783A	128	N234EZ	181	N999JD
23	N?	76	N9693A	129	N?	182	N70VE
24	N90331	77	N27CP	130	N18VL	183	VHIWS
25	N224DC	78	N281	131	N?	184	N103B
26	N68M	79	N101EZ	132	N17DR	185	N44EZ
27	N51WC	80	N4SN	133	N5WZ	186	N22803
28	N27CH	81	N6EZ	134	N41GL	187	F-PYHZ
29	N301RW	82	N81JC	135	N808CM	188	N77TJ
30	N179BB	83	N34VE	136	N?	189	N40EZ
31	N36RJ	84	N?	137	N26EP	190	N245EX
32	N3AX	85	N45846	138	VHDED	191	N11SK
33	N95DB	86	N752EZ	139	N27EZ	192	N99VE
34	N344SP	87	N28JF	140	N3KJ	193	N11SQ
35	N10	88	N13CG	141	N90395J	194	N55VE
36	N46JT	89	N?	142	N?	195	N24RW
37	DEEEZ	90	N17EZ	143	N7EZ	196	N2CR
38	CGMEZ	91	N240EZ	144	N4EZ	197	N37517
39	N111EZ	92	N21DN	145	N23FF	198	N45790
40	N?	93	N37S	146	NGLASS	199	N681JB
41	N79PJ	94	N7840	147	N5EP	200	N?
42	N?	95	N115AM	148	N56EZ	201	N13MW
43	N57EZ	96	N98CG	149	N8037T	202	N80JG
44	N2280K	97	N95F	150	N50EP	203	N10ZM
45	N88886	98	N25LP	151	N?	204	N?
46	N2TV	99	N33ST	152	N1WX	205	N?
47	N27RG	100	N45884	153	N60HD	206	N?
48	N575JW	101	N6LK	154	N2286A	207	N305Q
49	N22809	102	N29CE	155	N886	208	N77NS
50	N6459	103	N64CB	156	N859	209	N?
51	N378	104	N477CM	157	N46EZ	210	N80EK
52	NCGVEZ	105	N20VE	158	N877EZ	211	N80PB
53	N78PD	106	N9036G	159	N51935	212	N27GM

213	N101LE	225	N62MV	237	FPYHR	249	N1055K
214	N43TM	226	N13WM	238	N?	250	N20VE
215	N24BG	227	N99FW	239	HB-YBG	251	N28RR
216	N105OG	228	N857EZ	240	N8477T	252	N70VE
217	N34HA	229	N40LC	241	N39DB	253	N88EZ
218	N810TC	230	N15RL	242	N3762B	254	N5ZY
219	N24EZ	231	N16DT	243	N78BN	255	N8886
220	N32LP	232	N8021B	244	CGLJZ	256	N5021Y
221	N80681	233	N76PG	245	N86DH	257	N47EZ
222	N25RR	234	N56LC	246	N55VE	258	N34VE
223	N37LL	235	N80PW	247	N797MM	259	N14533
224	N45CR	236	N7AH	248	N67TR		

Comments from Jud Bock - "I have installed the Long-EZ nose and main gear on my VariEze so I am sure I will have a lot better landing gear system, but it is making me even more overweight than I already was. I decided the best thing to do about it was to lose 30 excess pounds off of my 230 lb body, which I have almost accomplished. Also my wife has lost nearly 20 lbs, so the 17 or 18 extra lbs I picked up on the bird is more than compensated for by the 50 lb weight loss of my wife and myself. I attend Weight Watchers and you can rest assured I am the only one in the class who isn't losing weight because of a woman or a man. My white, red and blue mistress has put on weight, so in order to be compatible with her, I had to lose or else become a single place pilot".

Fuel venting - Long-EZ
The Long-EZ fuel vent lines in the wing are positioned so their inlets are above the fuel level in level flight or climb. Thus air expansion with altitude increase is expelled out the vents with no fuel loss. However, when parked nose down with a large fuel load, the vent inlets are submerged. If the fuel caps were perfectly sealed, expansion on the ground due to rising air temperature could force some fuel out the vents. The fuel caps used in the Long-EZ do not provide an air-tight seal around the dzuz-head. Thus, this parked fuel loss will not occur. If you install a tightly sealed cap, like those on Mike and Sally's Long, consideration must be given to expansion. A tiny hole in the fuel cap will do, or you can install a second vent line with it's inlet at the far aft inboard top of the tank. This vent must be routed to the same outside location and orientation (into the airflow) as the other vent. We have tested an alternate configuration consisting of a small hole in the existing vent line where it enters the tank, however this configuration results in fuel loss in climb.

FLIGHT TEST DATA

Capt. Ken Swain of Travis AFB, CA., has recently conducted an extensive set of tests to document the performance of his O-235-F VariEze using his newest-configuration Scmitar prop. Data for his super-performing VariEze are presented below. Of significant note is the passive "constant-speed" action of the prop: full power climb at 80 mph results in 2800 rpm and at maximum speed in level flight (217 mph) rpm is only 2950. This results in a significant improvement in takeoff performance over a conventional prop that lugs the engine down to 2500 rpm at low speeds. Scmitar props have been flying since the 30's. However, they have not had adequate structural reliability. If a reliable full-Scmitar prop can be built, we will see very substantial low-speed performance increases in our high-speed fixed-pitch aeroplanes.

CP37, Page 9

CHART OF SCMITAR PROP DATA OMITTED

CP27, Page 10

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Predator Ag-plane in the wind tunnel. Photo courtesy of NASA.

Well folks, its done! **MIKE AND SALLY'S LONG-EZ**

N26MS - first flight with prototype 79RA.

Sally and son Keith rolling N26MS over in their garage. A winch holds the aft end up by the prop extension. A rafter was removed to allow the roll.

Richard White, at NASA Langley with this original Predator wind tunnel model.

Getting ready for 2nd flight of N26MS.

N12VV - Wayne Wilkins, on the gear.

Mike DeHate, from San Diego has installed this "quiet" exhaust system on his VariEze. It was designed and built by Rudi Kurth, and Mike reports that it is quieter than the standard exhaust system. Anyone interested in this should contact Rudi Kurth, Langgasse 51, CH-3292, Busswil, Switzerland.

In Switzerland, homebuilts have to meet strict noise controls, and Rudi has developed this system on his own VariEze and has over 200 hours on it now.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Bob Purdy's first flight in 216EZ.

The Tiffts and Defiant on the way to San Andros with no land in sight!

Excess baggage carried by Defiant to the Bahamas

Sleepy Ed Hamlin catching 40 winks!

Clarence Willwerth flying his fuselage around the garage.

Orville Winfield. VV being skinned.

Mule Ferguson entertaining the troops at San Andros.

Bruce and Bonnie Tifft's Beez enroute to San Andros.

Our trip organizer!! Bonnie Tifft.

The following letter was received just at press time for this newsletter. With Victor's permission we are printing it:

Dear Burt and Company,

Thank you for your Christmas card. It found me recovering from a crash landing of my VariEze and with even more respect for the design. On November 11, 1980 I was working to take off the 40 hours a bit at a time. We had about 30 minutes before dark after work (my second mistake) to get a few trips around the patch. Mary-Kate and I had decided to install the new Long-EZ elevator trim but I over-ruled and decided to put it off until certification (my first mistake). I wanted to complete the 8 hours remaining to my certification as soon as I could.

After one touch and go I was climbing out about 600-700 AGL when I eased the stick forward to level off at 800 and nothing happened. The bolt between BC4W10 and CS136 had come off. I immediately called "mayday" and requested emergency equipment. I thought I was dead. However, I realized 62MV was still climbing so I began to analyze my possibilities. I could not reach past my right leg to reach CS136 so I experimented with power changes. I found that at about 80 MPH indicated the nose would begin to drop and about 120 MPH it would pick up. The initial oscillations must have been 200-300 feet up and down. I found by careful throttle changes and by moving my body forward and backward I could greatly reduce the up/down changes, but I still was faced with only gross control. I flew 3 patterns, about 15 minutes, and on the last down wind discovered I could touch the elevator balance weight with my right toe. Holding about 100-110 MPH and using the toe technique to give progressive downward dips I made my final approach to runway 10 (4000' long) into a 5 degree right wind of 5 to 10 knots. At about 30 to 50 feet AGL, darkness made judgement poor, I was almost to the runway when the nose began its upward cycle at about 80 MPH. Knowing I would not stand another cycle, especially the 120 mile per hour dive I cut power and dropped it in. At the same time I cut power I deployed my landing brake, I probably should not have used the landing brake since it does tend to increase the sink rate.

The landing was just about 20 feet short of runway 10 in a slight left turn so that I skidded across the corner of the runway and onto the grass beside the runway. I came to a stop in the newly planted wheat field about 20 feet from the runway. I had lowered the nose gear to take up shock as well as the possibility I could make a controlled landing. The nose gear push rod bolt sheared, the main gear attach taps on the gear sheared or split , and the lower cowl was crushed. The intake spider broke and the carb separated as did the gascolator and intake hose. The oil pan was crushed and the bottom 3" of the firewall cracked and bent aft about 15 degrees. We hit so hard that the pilot's seat area broke and combined with skidding across the runway made a hole clear through the pilot compartment floor about 3" from the left console and about 9" wide by 20" long. I was able to turn everything off, release my harness and climb out. I noticed severe pain in my back so decided to lie down because the ambulance was pulling up. I next woke up in the ambulance on the way to the hospital. I suffered shock and two cracked vertebra #L2 and L3. After 11 days in the hospital and a month at home I am feeling pretty well. I will wear a back brace for at least another month but should not have any future problems.

Why did the nut (MS210042-4) come off? I don't know. I may not have had it on all of the way but I am sure I did because I had developed

the habit of checking for 2-3 threads through the nut. The canard and of course this nut had been off about 10 times for work on the electrical and instrument systems. Do such nuts wear out? The nut and bolt are included for your inspection. I find I can get it on to almost one thread with just my fingers. The FAA inspector was Glenn Martin of Wichita GADO. He was just as surprised as I to find out the a VariEze will fly without elevator control.

N62MV normally trimmed out level with a slight nose down force required. I was able to correct it with the original spring trim system. At the time of this flight I had 2 gal in the fuselage tank and about 7 gal total in the wing tanks. The engine is an A80-8 and the original long canard is installed.

I expect to wait about a year before repairing the plane. What do you think of having the main gear strut and wing attach areas x-rayed? There doesn't appear to be any damage to the wing or canard attach fittings or surrounding areas. Both lower winglets were ripped off, right rudder was destroyed and of course the gear and gear attachment area. The enclosed photos were taken by Glenn Martin. I would like to have them back because they are all I have. Enclosed find SASE.

Thanks again for an outstanding design. If you would want to question me please feel free to call.

Sincerely,

Victor Sullivan

It should be emphasized that an elevator disconnect downstream of the trim system will not necessarily result in the amount of control Victor was able to achieve. Any small inconsistency in elevator shape could result in a very low or very high trim speed. Victor had rejected his original elevators and build new ones to a more accurate shape - he probably could not have survived a control disconnect with the original ones. The new trim system, of course, could have allowed a satisfactory amount of control and safe landing.

We have inspected the bolt and nut and found it is of the proper length and that the locking friction, though reduced from new condition, seems adequate for proper safetying. It appears improbable that it could have been tightened properly. Victor agrees that it may be possible that he was distracted during canard installation and might not have tightened the nut beyond finger tight. Even the most critical items can be overlooked by the most competent mechanic. For example, one VariEze attempted a takeoff without the 2 bolts that hold the canard on - the canard flew off when the pilot pulled the stick back for rotation. Builders should follow the accepted practice of replacing critical locknuts after several repeated installations (discard any fiber-lock nuts after one use). Also, discard any bolt or nut that has any sign of reduced locking friction.

FAST - EFFICIENT - HIGH UTILITY - LONG RANGE

Long-EZ N79RA with 75 gal. back seat tank during the world distance record flight. **PHOTO OMITTED

THE AIRPLANE
The Long-EZ is a small, high-performance, high-utility homebuilt sportplane. While recommended mainly for Day-VFR operation, competent pilots can also equip it for night and IFR flying. Power plant is either the 0-235 Lycoming or the 0-200 Continental. It has an alternator-powered electrical system and can be equipped with electric engine starter. It's cockpit layout is designed to compliment pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wing strakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 P.V. core foam. (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal or wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

TRAVELLING MACHINE
At last, an airplane that is specifically developed for efficient, high speed, long-range travelling with room for two adults and plenty of baggage. Fuel allowance with two adults is 38 gallons. Single-place, you can carry 52 gallons! If you're in a hurry, you can cruise at 75% power at 8000 ft at 185 mph (161kts), burning 6.51 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles), in 5.2 hours with a 40 minute fuel reserve. If you're not in a hurry, you can cruise "economy" at 12000 feet at 144 mph (125 kts), burning only 3.52 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 10 hours with a 40-minute fuel reserve. Single place, using the entire 52-gallon fuel capacity, stretches the maximum range and endurance to over 2000 miles and 16 hours!

The high efficiency, long-range capability increases a pilots options for fuel availability and weather detours. The fact that the Long-EZ can carry the same load and fly as fast as other 160-180 horsepower aircraft, means large fuel savings - 29 mpg at fast cruise, 41 mpg at economy cruise.

UNUSUAL EFFICIENCY
The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for

efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a worlds distance record, and landing with enough fuel to surpass 5000 miles. At that, it's capability was not taxed - it's initial climb rate was over 600 ft/mn! At light weight, it climbed to 27000 ft in still air - an altitude unheard of for a fixed-pitch, non-turbocharged airplane. Our Long-EZ is so efficient, the engine can be shut down while at 5-ft altitude over the numbers at only 120 knots, then it can pull up, fly at 360 degrees pattern and land on the same runway - completely without power! It's power-off glide angle is only 3.7 degrees - thus a belly-mounted drag devise (landing brake) is used for landings.

SUPERB FLYING QUALITIES
Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and safe stall characteristics. It can be maneuvered sharply, even to full aft stick, without fear of stall or spin. Flight tests show the prototype to be free from stall departures and spins for all types of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed.

Trim changes due to power, gear retraction or landing brake are all very small. It's wide cg range allows a large range of pilots or passengers weighing up to 240 lbs.

The Long-EZ's approach and landing speeds are 75 mph (65 kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.

THE HOMEBUILDER SUPPORT
The Homebuilder support. The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

THE TEST PROGRAM
The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

COST AND BUILDING TIME
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, VFR instruments, plumbing, tools, tires, wheels, brakes and upholstery (cushions and special suitcases) costs about $2,900. Any of these

items can be purchased separately. We strongly recommend that you get the distributor's catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

The S-glass roving molded structural fiberglass main gear and nose gear are available from RAF, at $277.95 and $49.75 respectively. Many other prefab parts ranging from propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased from the listed manufactures. All those prefab parts cost approximately $1,600 - and using them, the competent builder can build a Long-EZ in as little as 800 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above cost of the prefab items. Contact the manufactures for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

Engine costs vary widely. Our prototype has an 0-235 Lycoming that had 1400 hours, when purchased for $1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from $3000 to $6000. Engine accessories, such as instruments, prop extensions etc cost about $300 to $500. In summary then, total cost can run from $5300 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $9900 for everything available purchased and a zero-time engine. IFR avionics can add from $2000 to $15,000 to those numbers, with many options available.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.
Empty Basic	710 lb.
Empty Equipped	750 lb.
Solo Weight	960 lb
Gross Weight	1325 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	550/830 ft
Climb (solo/gross)	1750/1350 fpm
Cruise 75% 8000 ft	183 mph
Cruise 40% 12000 ft	144 mph
Max range * 75% (solo/2 place)	1370/965 mi
Max range * 40% (solo/2 place)	2010/1430 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine

installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200
SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order. Newsletter not taxable.		
TOTAL		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $3

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $3

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Sally Melvill taxiing out for first Long-EZ solo flight.

Long-EZ parked nose-down with two VariEzes.

The nose gear retracts for parking and in flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 28. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 28. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 28. If you are building a VariEze from 2nd Edition plans you must have newsletter 16 through 28. If you are building a Long-EZ from 1st Edition plans you must have newsletter 24 through 28.

A Current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave CA., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins. When arriving at Mojave by car turn east at the Carls Jr restaurant to find the airport.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed your reply.

RAF Activities.

We are pleased to announce that we have entered the Soaring Society of America's contest to design and build a home-buildable single-place, self-launching sailplane. Because of the competitive nature of this event, we regret that we can not release any details concerning configuration, power, performance, or method of construction. There are currently 55 official entries in the SSA's contest, which was announced in September 1980. The fly-off and evaluation of all entries is planned for the summer of 1982. Please do not call or write to us for information on our entry. All information that we feel we can discuss will be released right here in the Canard Pusher. This is also

in line with our policy not to put out information on any project we may be working on until we have flown it successfully.

Saturdays from 11:00 am to about 2:00 pm have been very busy with from 30 to 100 visitors showing up at the shop. Generally we have the VariViggen, the VariEze and two Long-EZs on display. We have been showing the construction video tape plus a very entertaining tape of RAF planes flying formation. We then generally have a "bull session" answering any builder or pilot questions and wind up with flying one or all of the airplanes, at around 1:00 pm.

RAF will be closed and the Saturday demo not given on the following dates:

23 May	Watsonville Fly-in
20 June	Cafe Race 250
1 Aug & 8 Aug	Oshkosh EAA Convention

Video Tape

We recently completed our video tape on construction techniques used in building moldless foam/fiberglass aircraft structures. This video tape should be a valuable tool for the first time builder as well as the experienced builder. It runs for 96 minutes and thoroughly covers every phase of construction including health precautions, foam preparations, hot wiring, foam damage repair, epoxy mixing, the use of micro balloons, flox, fiberglass, both UNI-directional and BI-directional, wing shear webs, wing spars, wing skins, leading and trailing edge treatments, corner tapes, peel ply and much more. This tape is available from RAF for $49.95 in either Beta II or VHS (half inch format).

Newsletter list goes on the Apple. We now need your number !

You've all heard good-news bad-news stories. Well, the good news is that RAF is in the process of putting the growing Canard Pusher subscription list on our Apple computer, which will hopefully make the system, by which you receive your copy every three months, more efficient. In the past the mailing labels have been typed by hand - a tedious task at best. Computer-generated labels will speed up the processing of address changes and renewals. This improved system will benefit you as a subscriber.

Progress is not made without sacrifice, however. We realize that the change over to the computer may not be flawless and ask that you be patient with us during the transitional period. Names go on the computer as we receive new subscriptions or renewals, so it will take a full year to use up all the hand-typed labels and get all subscribers on the system.

The bad news is that in these number-oriented times, we are asking that you keep track of yet another number! Each subscriber will have a unique subscription number which will be the first number in the first line, right after the # sign.(#100 in the example). As in the old system the issue number of the last CP you will receive before your subscription runs out will also be in the first line, only now it will be much more obvious.

#100 Last issue - CP 34.
John Doe,
1234 Main Street.
Anywhere, USA 9999

When you renew, or if you have a question about your subscription, please mention your subscription number, or send in an old label. This will greatly speed the processing of your order.

None of us are thrilled with the prospect of losing our identity and being reduced to a number, so we'll let you in on a secret. We will be able to find you by your name, (as long as the computer hasn't misspelled it!) if your Great Dane eats all of your back issues and you can't remember your number due to the temporary amnesia you incurred while chasing the dog around the house, slipping in the wet epoxy on the floor and hitting your head on the corner of your work bench! This is the only excuse we will accept, however! Our system is small and limited - please help us with this so that we can all benefit from the system and so that RAF can be of better service to our Canard Pusher subscribers.

It has become necessary to further clarify Rutan Aircraft's position in relation to the homebuilder and the support we give. Rutan Aircraft can only offer the assistance that helps them interpret the plans when they desire to build their aircraft like the prototype we have tested. We cannot assist in the design and construction of modifications. We cannot comment on the advisability of modifications. Many of the developments we design and test do not work as predicted. Thus, without testing your idea we cannot reliably predict its success. A similar situation exists for substitutions of materials. We will not be able to advise you on any material we have not tested ourselves.

AD-1 Reaches 60 degree Wing Skew in NASA Flight Tests.

The RAF-designed AD-1 jet research aircraft has successfully completed initial wing-skew-angle envelope expansion flights tests with the wing being skewed to its 60 degree limit. Although the sensitivity, yaw trim change and coupling were noted, flying qualities at full skew were better than anticipated.

The AD-1 airframe and its two TRS-18-046 jet engines have required no repair or unscheduled maintenance during the test program. The 100% availability is unusual for a research aircraft. For further information on the development of the AD-1, see Canard Pushers No 10, 11, 17, 18, 19, 20, and 23.

Video Tape (See Page 1) Add $4.00 for postage and packaging for mail orders. The $49.95 price is for walk-in customers at RAF.

26MS - Mike and Sally's Long.

Currently we have 85 hours on our Long and it is literally running like a Swiss Watch. We are truly delighted with it in every possible way.

We have been using it to commute to work every day for the past couple of months. From Techachapi to Mojave by road is 26 miles, about a 30 minute drive. It takes between 8 and 12 minutes in the Long, depending on the winds. We use two to two and a half gallons for the round trip. This is almost exactly what we use in our Honda Civic car. Besides the time saved the biggest thing is the 'fun' factor. There is a lot of enjoyment in flying across the desert in the early morning with glass smooth air, no traffic and the stereo tape deck playing in the head phones. Coming down-hill in the morning, we usually fly at very low power settings. The quiet, smooth exhilaration really makes it enjoyable to come to work.

All flight tests, engine break in etc., have now been completed. All systems work perfectly. The Radair comm, nav, and transponder work very satisfactorily. The Sigtronics intercom and audio switcher work excellently in conjunction with our stereo tape deck. This also gives us the capability to transmit from either cockpit. The newest piece of equipment recently installed is a Silver Fuelgard. This small instrument accurately reads out fuel flow in gallons per hour and you can look at fuel used with a momentary switch. This fuel flow meter is a TSO'd instrument and uses a flow-scan transducer. We installed it in the fuel line so that all fuel on board runs through it. It is accurate within +- 2 percent. So far it has verified the Owners Manual fuel flow information very closely. N26MS will burn 1.9 gallons per hour at minimum power required for level flight at 8000 ft (max endurance) and at 75 percent at 7/8000 ft it reads 6.7 gph. Take off, full rich at sea level is a shock, 11.7 gph!! On a recent cross-country, we went to Northern California, a straight line distance of 404 nm (471 sm). On the trip up north we had a ferocious head wind of 29 kt (33 mph) so we ran at approximately 70 percent power at 8500 ft for a fuel flow of 6.4 gph. This gave us a ground speed of 130 kts (150 mph) with a true airspeed of 159 kts (183 mph). Our time enroute was 3.1 hours and we used right at 20 gallons of gas. By contrast on the return trip we had a tail wind!! We climbed to 11,500 ft, where the tail wind component was 35 kts (40 mph). It took some will power, but we pulled the power back to approximately 48 percent which gave us a fuel flow of 4.4 gph, and a true airspeed of 133 kts (153 mph) which, with the tail wind, had us crossing the ground at 168 kts (193 mph). The time enroute was 2.4 hours and we burned a total of 10.6 gallons of gas! I honestly believe that a Long-EZ built to the plans will consistently give these kind of results. The airplane is incredibly comfortable, reasonably quiet, particularly with David Clark headsets, and is an honest to goodness, economical, high speed touring machine, with good baggage capacity, excellent high altitude capability and unbelievable range. All in all, looking back at the intensive effort required to build it, it was well worth it!! The Long continues to delight us, Sally takes it to her 99's meetings, I have been into terminal control areas, we have flown it quite extensively at night. We have flown over mountains, over ocean (to Santa Catalina) and it is just super. The Lycoming O-235-L2C has continued to run like a dream and to be honest, I have no regrets. If I had to do it again, I would build it exactly as we did, using the same engine. The only thing I would not recommend is the electrical system we have. The engine came with a 28 volt starter and alternator, and all the electrics on the airplane are 12 volt. We have got it working, but it was simply too much hassle for the average builder to have to put up with, when you

don't have to. N26MS will be here at RAF on a daily basis, and we plan on attending most of the flyins, including Watsonville and Oshkosh.

Long-EZ #4 by Dick Rutan.

Last summer Mike Melvill and myself decided to build ourselves one-each Long-EZ. We agreed to work together on the basic structure then split off and finish individually. On 15 June 1980 we started and with a lot of help from Mike's wife Sally and my friend Jeana Yeager both aircraft are now flying. Mike's (N26MS) late December 1980 and mine (N169SH) in early April 1981.

Mine took longer to build for two reasons. First, Mike worked harder, but the biggest reason is all the changes I made to mine. I thought I wanted more power, more roll rate, more negative g and IFR equipment. I installed a bigger engine, longer ailerons, different canard airfoil and several other changes. All these mods took more time to build, cost more and after first flight, I found they didn't work. When I should have been very happy after it flew I was not. Instead of having an aircraft I could use I found I had a "prototype" that needed work. The big engine over-heated, the revised canard airfoil resulted in loss of speed-stability at high speed, and very poor stall characteristics (a nose drop). The standard Long-EZ rolls about as fast as mine and because of a poor prop match, Burt's Long even out-ran me on the first flight! I was then faced with finding fixes for all the problems.

I'll fix the problems but it will take some time and effort. But in retrospect, I wish I had stayed more standard. My airplane now is a compromise, a whole bunch more effort that I feel is not worth it.

If you see my light-blue modified Long-EZ (N169SH) at flyins and airshows, remember the mods were not approved by Burt or RAF. In fact Burt was not aware of most of them. Please don't bother RAF about my mods. They have enough to do just to support those building from the basic plans. I do not intend to do as complete a test program on my airplane as RAF did on N79RA. Thus, they are in no position to verify or recommend my modifications.

I am now deeply involved in the Voyager round-the-world program and will not be able to get involved in any way assisting builders.

I don't recommend any of the changes I've made and wish I had not. The best advice I can give is to keep it stock, build it light, and resist the temptation to change, especially anything structurally.

Sun-n-Fun Flyin.

Although none of us from RAF were able to make it over to Sun-n-Fun, RAF was very well represented by Irene Rutan (Burt's Mom) with excellent help from Johnny Murphy. Irene recorded 24 VariEzes and 1 Long-EZ that landed at Sun-n-Fun during the week up til Friday, when Irene had to leave. Here is a list of pilots and their airplane "N" numbers:

Johnny Murphy	Long-EZ	N21VE
Tom Bradford	VariEze	N25TB
S.E. Cochran	"	N115AM
Dick Cutler	"	N46RC
Norm Dovey	"	N16ND
Frank Dudley	"	N20VE
Mule Ferguson	"	N2286A
Tim Gehres/Steve Wood	"	N56EZ
Dave Hesterlee	"	N86DH
Larry Hoepfinger	"	N7AH
Gerry Mason	"	N27GM
David Richter	"	N877EZ
Ray Richards	"	N48EZ
Robert Ridihalgh	"	N25RR
Ed Rockwell	"	N7ER
Jack Sargent	"	N75EZ
George Scott	"	N240EZ
Earl Thompson	"	N55EF
Jim Trombino	"	N46JT
L. Uhley/P. Mason	"	N2UN
Joe Walker	"	N419JW
Fred Wimberly	"	N99FW
Bob Woodall	"	N301RW
Don Yoakam	"	M77DY
David Langston	"	N83DL

VariEzes made the front page of the St. Petersburg Times twice during the week. The VariEze race was held over a 49 mile course on Friday morning, and on Friday night the whole group got together to swap tall stories. Irene reports that VariEze pilots/builders are the finest people in the country and she was proud to see so many beautiful ships flown in for the folks to see. She wants to thank all those who were there for being so good to her and showing her such a great time. She loved every minute of the week.

Tim Gehres sent us the results of the race, held on Friday. Ten people entered and 8 raced. The race was a handicap race, based on the Owners Manual performance, baseline being a VariEze with an O-200 with wheel pants and a spinner. Congratulations to Paul Mason who won (his corrected speed for the race was 182.23 mph). George Scott was second at 170.77 mph and Bob Woodall was third at 169.54 mph. Johnny Murphy flew his Long-EZ in the race, although he was not an official entry and surprisingly his speed would have placed him second at 177.10 mph (good show Johnny!). Tim Gehres also was not an official entry and his speed was a blazing 183.9 mph! We would like to thank Tim Gehres and Steve Wood for the work they put in in organizing and running such a successful race. Hopefully this can become a traditional event each year.

Memories of Sun 'N' Fun - 1981
by the "Real" George Scott.

1. Dave Hesterlees VariEze rising through the North Georgia haze as he departs Bear Creek airport right on schedule to wing into formation with us on the way to Lakeland.

2. The chatter of the ground controller at Gainesville Florida wanting all the performance specs on the EZs.

3. Rapid fire direction from the tower controller at Lakeland. He says "Don't talk to me, I'll talk to you" and then proceeds to ask if we want to make a 360 degree turn behind the STOL or what?

4. As we taxi through the Warbird parking area all thoughts of the spectators leave WW II and join Star Wars.

5. The envy of all, as Johnny Murphy comes winging in via his Long-EZ "Sweet Music".

6. How Eze the tie down stakes go into the Florida sand, compared to the Oshkosh black soil.

7. Yes, they still ask "Where is the tail wheel?" "What's the solar panel for" and "Where's Rutan".

8. Tim Gehres and Steve Wood trying to coordinate their work schedules, commute from Orlando and still organize the VariEze Race.

9. Paul Mason calling every day with excuses as to why he couldn't run the race but winning anyway.

10. Dave Richter on a nationwide tour from New Jersey to Lakeland, to the Islands, to the West Coast, to Alaska, to Oshkosh and beyond. (Dave, are "C" rations any better than they were 25 years ago?)

11. At the IVHC banquet a couple of local patrons ask, "What's a VariEze?" and 12 people all explaining at once.

12. Irene Rutan traveling all the way from the West Coast and spending all week logging in VariEzes and helping to pass the word on RAF.

13. Jeff Rose smiling when he explains the comparison of flying the VariEze, the Long-EZ and the Defiant. (How many of us have accomplished that?).

14. My sweet little wife working two days parking big ole airplanes and how proud she is of the volunteer patch she's earned.

15. Mule Ferguson scaring the devil out of the spectators with his ugly green mask.

16. VariEze pilots sneaking a peek at the canard ultralite "Goldwing" (Don't tell Burt!).

17. How the tower Controller's voice changes with a little respect when he recognizes a real VariEze in the pattern.

18. We vow to install cabin heat in the Long-EZ when the OAT indicates 20 degrees F at 5500 ft and my toes chatter against the rudder pedals.

19. John T. Baugh's pet monkey visiting the VariEze crowd.

20. The strong Lakeland winds blowing from the West seemed to carry a faint odor of Safe-T-Poxy. Could those winds have carried a hint of RAF's latest project?

A note from EZ Ed - owner of one of the highest time VariEzes.

Burt asked me to jot a note for the newsletter since at this writing (4/22/81) I have 680 hours on 777EJ. It first flew in March of '78 and since that time we have really flown it quite regularly. In '78 we went to Oshkosh plus explored all of California twice. In '79 we made a trip through Canada, we were going to Alaska but "someone" got carb ice and Joanne had a tooth go bad in Calagary. In 1980 we went to Montana (home again) and toured some in that area. We also made the Bahamas trip in '80-81 to cap off '80 and start '81. At Easter we went to Loreto Baja Sur, Mexico. Had a really great time.

The reason that the hours build up on 777EJ so fast is that I also use the airplane in my work. I work for Placers Savings and we have 22 branches. I visit each branch at least once a month and often more frequently. I average flying to a branch once or twice a week, (the boss buys the gas) so we really get to keep the cobwebs off Echo Juliet.

As far as maintenance goes I really haven't had any major problems. The engine has run great but I did a top at 400 hours and had one wierdo, a warped intake valve seat. Those two problems though didn't stop the flying for long.

I have used a lot of brake pads as the airplane is an all brake situation after it's on the ground. I can touch down say at 75 mph on a 5200 ft runway, (I did it at Mendocino, with a passenger) and probably would go off the other end. That's with speed brake down and rudders extended. If I ever suspected I didn't have brakes I would land nose gear up. A 2" x 3" x 1/4" steel pad is good for at least 3 nose gear up landings!

When we get 1000 hours we will write another article.

Ed Hamlin.

New Book Details Rutan and RAF Evolution.

A new Tab publication (TAB books, Blue Ridge Summit, Pa, 17214) written by Don and Julia Downie, titled "Complete Guide to Rutan Homebuilt Aircraft" is now available. It is the result of several months of research by the Downies. While much of the book consists of previously published information, the reader who is curious about the early years of Burt Rutan's aircraft work will find extensive information never before written. Also the book is profusely illustrated with over 100 photos.

Care of Composite Structures

Composite aircraft such as the VariEze and Long-EZ should have a virtually unlimited life, provided they are reasonably well taken care of. In addition to normal maintenance as required for the systems, oil and grease where required, etc., it is very important to immediately repair any dings, chips or scratches in the paint/skin as well as the cockpit interior. Any scratches or chips that expose the epoxy/glass structure are subject to immediate ultra violet degradation and/or water absorption, depending on the degree of damage. Skin damage that exposes the epoxy/glass structure can result in water being absorbed into the laminate, and then when the water freezes (expands) there is a possibility of local delamination damage.

To sum up, all hangar rash, scratches, chips etc., in the finish should be repaired and repainted as soon as possible.

Safety-T-Poxy and Humidity.

Good news! The manufacturer of Safe-T-Poxy has confirmed that this type of epoxy can be used in up to 90 percent humidity with no problem. This will be a big help to those of you who live in areas with high humidity. Of course temperature is still very important and although it is possible to make a satisfactory layup in temperatures as low as 65 degrees F, and as high as 100 degrees F., the ideal temperature is 75 to 85 degrees F. Safe-T-Poxy is relatively insensitive to moisture and that is why it can be used in an environment with high humidity. This also a tremendous advantage over the life of your airframe, since the cured laminate is also more immune to water absorption than normal epoxies. This reduces the possibilities of weight gain through water absorption, a common problem with most epoxy laminating systems.

Caution. We have been approached lately by builders wanting to use Ciba Araldite 506/507 epoxy to build their Long-EZ or VariEze. We cannot recommend the use of this material. The heat distortion point of this laminating system is low and can cause long term "creep" problems. The water absorption is high, which will hurt the life expectancy of the airframe. The chemical make up of this material is such that many builders will become sensitized due to high irritation factor.

Remember, Rutan Aircraft Factory, Inc., has spent many thousands of hours, building, testing and flight testing the prototype aircraft that we sell plans for. For us to recommend any material that we have not tested in an aircraft that we are currently flying would be unethical. We have learned that another plans distributor has shifted their recommendation to a cheaper epoxy even though their prototype is not build from the cheaper material. This practice is, in effect, asking homebuilders to test something new to see if it is adequate. This practice is acceptable because each homebuilder is the manufacturer of his own aircraft. However, we feel that ethics require that if a homebuilder is breaking new ground he should be notified that he is being recommended to use something that has not been tested on a prototype.

VariEze stall Characteristics and CG Position.

We recently received a letter from Shirl Dickey of Utah, notifying us of his initial flight tests of his new EZ, N60SD. His letter is printed below:

Dear Burt,
I just wanted to drop you a note telling you of the first flight of VariEze N60SD. My bird is equipped with an O-200 Continental, wing cuffs, speed brake, full instrumentation and a Cessna alternator. I am planning on installing a lightweight alternator.

Sunday morning 2/22/81 was clear, calm and cold, a perfect day for taxi and flight tests. Bruce Tuttle flew his VariEze N95BC down from Ogden and was on hand for help with initial setup and check out of my new bird. Another builder John Wall was also very helpful.

Bruce and I discussed the procedure I would be going through starting with low speed taxi tests, high speed taxi tests and runway flight. All went per plan until I attempted my first runway flight. I had accelerated to 80 mph and pulled the power off and with pitch up command it lifted off and went unexpectedly to 50 feet. I could see that I would not want to attempt a landing on the remaining runway and so after only a slight period of indecision I added power and climbed out.

That first lift off and flight came somewhat unexpectedly and I was immediately filled with apprehension about landing. This was where all my practice in a Cessna 172 and Mooney 231 would have to pay off. I brought it around the pattern at 100 mph on downwind, 90 mph on base and 80 mph on final. I approached low with slight power and crossed the numbers with the runway visible over the nose. Then I chopped all power and it sank unexpectedly fast and my reaction was to pull up elevator, which wiped out my view of the runway and I found myself feeling for it for a nose high landing. Not too graceful but I got it down on the mains and then dropped it on the nose pretty hard.

The roll out was exhilarating. It was the first opportunity that I had to think about what had just happened. We checked the plane out for landing damage (none) and then it was off again. All in all the first flights were so successful that I logged 6.1 hours that day including about one hour flown by Bruce, and some formation flights alongside his Eze. My wife, Diane rode with him and took some air to air pictures. I also flew some long orbits within my restriction area getting the feel of the plane.

No slow flight was attempted but I did investigate high cruise. I got 160 mph indicated at 8000 ft. straight and level which trued out at 181 mph (no wheel pants, no spinner and no nose gear covers) at 2800 rpm.

The only flight problem was a slight left baking tendency. It flew ball-centered with no yaw trim. Roll rate was fantastic, with the rudders it was really quick. Stick forces were roughly equivalent for pitch and roll and very comfortable.

I ended up the day doing touch and go's, working on my technique, I found that it was best to carry a slight amount of power and fly it onto the runway, a Cessna-style flare always resulted in a nose-high, high sink rate landing and so I soon learned not to do it that way. As

the sun was dropping low I reluctantly had to call it a big day and put my new toy away.

The aircraft is everything I had dreamed of and more. It made the 23 months construction period seem like nothing compared to the pay off in fantastic performance and pride of building and flying my own airplane.

Thank you is just not enough to say to you for providing this fantastic design for me and others who have a little ambition and a big dream.

I hope to fly off the restrictions in about a month and one of my first cross country flights will be to Mojave to show you the plane and thank you in person.

Thanks again and I'll be seeing you soon.

Shirl Dickey.

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Shirl's initial stall tests were done with nose-ballast as required to bring the cg into the center of the first flight box. Stall characteristics were correct - a stable trim at full-aft stick. He then removed his note ballast which resulted in a cg of approximately 101, about 1 inch forward of the aft limit. The stall characteristics at that cg were not desirable. He reported that an excessive angle-of-attack could be reached using only a few degrees of elevator travel, and the aircraft would roll-off on the right wing before full-aft-stick was reached, particularly when stalled at low power.

When he reported these characteristics to us we asked him to recheck cg because those characteristics normally occur only when the cg is aft of the aft limit. We also asked him to check the contours of his wings for any inconsistency that could cause premature stalling. He did, and was unable to find anything wrong. Shirl and Diane flew into Mojave last week on their first long trip in their new VariEze. Dick and Mike flew it, evaluating the entire flight envelope. N60SD is an excellent flying machine with good roll rate and control harmony. It's stall characteristics, however, are not how a VariEze should be. Instead of the stable trim condition normally obtained at full-aft-stick, N60SD behaved as it wanted to drop a wing unless the pilot carefully controlled ailerons and rudder. Also, the nose seemed to trim to a higher angle than the prototype, N4EZ.

Remembering that these were the characteristics that existed with N4EZ when it was tested at a cg aft of the aft limit, we were convinced that Shirl had done his weight and balance incorrectly. So, we rolled out the platform scales and lifted N60SD onto them. The mystery, however, still existed when the numbers were all calculated - we obtained the same cg that Shirl had reported. We measured the planform dimensions and confirmed that his airplane seemed to be built accurately. It must be that his airplane does have some difference in incidence or contour of the wing or canard, however, we did not determine this.

When Shirl and Diane left, all we could tell them was to go ahead and install 12 lbs of permanent ballast in front of the battery to keep the

cg forward of station 100, thus resulting in the desirable stall characteristics that VariEzes should have.

The purpose of telling you this story is to reiterate to all builders that they cannot assume that each airplane is identical to our prototype. We have learned that variations are to be expected, since these airplanes do not come out of one mold in one factory. Thus each manufacturer should start his test program at the most conservative condition (center of first-flight box cg, for example). Then, as described in the Owners Manual, open the envelope slowly, carefully and safely. Place the limits on your individual aircraft where they properly belong, rather than assume they will be identical to the limits used for N4EZ.

Leaning for Cruise.

Few Pilots realize the extent of fuel economy benefits available when an engine is leaned to proper "best economy" (BE) settings. Due to cooling requirements, BE setting (50 degrees F on lean side of peak EGT) is allowed only below 65 percent power. Lycoming-supplied data shows that a BE, specific fuel consumption is 14 percent lower that at "Best Power" leaning (approximately 90 degrees F on rich side of peak EGT). A pilot that cruises at full-rich is not only damaging his engine and fouling plugs, but is burning up to 55 percent more fuel than at the BE setting! Always lean at least to peak EGT when cruising with less than 65 percent power.

How much Power?

One of the basic functions of the aircraft designer is the sizing of the aircraft such that the selected powerplant is correct. An engine too-small for the aircraft results in inadequate climb in high-altitude summer conditions or an unacceptably long takeoff roll. Too large an engine is wasteful of fuel because either the high cruise speed is at an inefficient flight condition for the airframe (low cruise lift-to-drag ratio), or the engine itself is inefficient when throttled back to obtain the speed for a good lift-to-drag ratio.

If a designer attempts to select an engine for optimum cruise efficiency, i.e. at a flight condition for maximum miles-per-gallon he finds the engine inadequate for climb. This situation is not unlike that of the automobile designer who finds his vehicle is cruised at a speed far in excess of that for the best mpg. However, the designer knows that the airplane should not operate at best L/D (or best mpg) anyway, since this is not practical unless you are setting a distance record. Increases in speed above but near the best mpg speed result in only small losses of mpg. But, as the speed increases considerably above the best mpg condition, the mpg drops drastically. The big question, then, is how fast should you really fly? If this question can be answered, then the designer can size the engine for this practical speed.

Aerodyanmicist, Dr. B. H. Carson of the U.S. Naval Academy has published an excellent analysis of the fuel efficiency of light planes (AIAA publication 80-1847) and has presented theoretical rationale for practical cruise efficiency. His interesting technical treatise is beyond the scope of this article, but the summary of findings is of

interest to pilots. Rather than focusing on the cost per distance (mpg), he finds the speed that gives the minimum cost per speed. This "cruise optimum" speed corresponds to minimum outlay in extra fuel (over best mpg) per increment in additional speed. This speed corresponds to the closest approach of the airplane to a "technology barrier" of efficiency proposed by Gabrielli and Von Karman in an article "What price speed?" published in Mechanical Engineering Vol. 72 October 1950.

This "cruise optimum" speed, at 32 percent over the speed for best mpg, results in a 16 percent increase of total fuel used, requiring a 52 percent increase of power and saving 24 percent of flight time. This speed is regarded as the most productive use of excess fuel for cruising. The pilot should consider it his best "economy" cruise speed.

Accepting this theory, lets see what the resultant engine size is for the Long-EZ. At 8000 ft. altitude and 1325lb. weight the "cruise optimum" speed is 139 kt. (160 mph) and required 47 thrust horsepower (55 brake horsepower). This is a power setting of less than 48 percent power when using the 118 hp O-235 Lycoming. This suggests that, for 65 percent power cruise (to allow operation at lean side of peak EGT), the ideal engine for a Long-EZ should have 86 BHP. However, here is where the theory breaks down. The "Long" is a fast aircraft for a fixed-pitch prop application. Thus, with the low prop efficiency at slow speeds, it requires a 100 BHP engine for satisfactory take off performance.

The larger engines, 160 BHP for example, are wasteful of fuel at any speed. This is because specific fuel consumption (SFC) increases as the engine's power is reduced below 75 percent. The accompanying graph obtained last month shows this trend. Data are for best economy setting, about 50 degrees F on lean side of peak EGT.

If a Long-EZ is cruised at "cruise optimum" speed, its O-235-L2C engine will burn 8 percent less fuel than would an O-320-B at the same speed. (48 percent power for the O-235 and 36 percent for the O-320). If both engines were run at 65 percent power the O-320 would burn 22 percent more fuel than the O-235 for a given trip.

The following table shows data from a computer printout using the performance parameters for the Long-EZ, and assuming sfc equal 0.5.

Long-EZ weight equal 1325 lb.
Sea Level. * denotes 8000 ft.

Data for sfc equal 0.50

True Speed Knots	Indic Speed Knots	Req'd THP HP	Induc THP HP	Prop eff Percent	Req'd BHP HP	Fuel Flow GPH	Naut Miles/ Gallon	L/D Ratio
90	90	21.8	7.7	65.7	33.2	2.76	32.58	16.8
100	100	26.2	7.0	70.7	37.1	3.09	32.34	15.5

110	110	32.0	6.3	74.9	42.7	3.55	30.96	14.0
120	120	39.1	5.8	78.5	49.8	4.15	28.94	12.5
130	130	47.7	5.4	81.3	58.6	4.88	26.62	11.1
140	140	57.8	5.0	83.4	69.4	5.78	24.23	9.9
150	150	69.6	4.6	84.6	82.3	6.86	21.87	8.8
160	160	83.2	4.4	85.0	97.9	8.16	19.61	7.8
170	170	98.7	4.1	84.6	116.7	9.72	17.49	7.0
180	180	116.2	3.9	83.4	139.3	11.61	15.51	6.3
* 90	79.8	20.9	9.9	65.7	31.8	2.65	33.97	17.5
*100	88.7	24	8.9	70.7	34	2.83	35.33	16.9
*110	97.5	28.2	8.1	74.9	37.6	3.14	35.08	15.9
*120	106.4	33.5	7.4	78.5	42.7	3.56	33.71	14.6
*130	115.3	40.1	6.8	81.3	49.3	4.11	31.67	13.2
*140	124.1	47.9	6.3	83.4	57.4	4.78	29.26	11.9
*150	133	57	5.9	84.6	67.4	5.61	26.72	10.7
*160	141.9	67.5	5.5	85	79.5	6.62	24.17	9.6
*170	150.7	79.6	5.2	84.6	94.1	7.84	21.69	8.7
*180	159.6	93.2	4.9	83.4	111.8	9.31	19.33	7.9
*190	168.4	108.5	4.7	81.4	133.3	11.11	17.11	7.1

GRAPH "FUEL SPECIFIC AT BEST-ECONOMY MIXTURE" OMITTED

Weight Control.

CAUTION - Weight growth generally occurs late in the building project. The following scenario occurs during most homebuilt aircraft projects: Careful weight control is exhibited in the fabrication of the various bulkheads, wings etc., in building the basic structure. The builder is optimistic about the prospect of having a light weight aircraft, because all his components meet or beat the various weight goals. Then, when he begins the final stages of outfitting and finishing he relaxes his concern for weight control. He says "oh, this is only a few ounces, a small percentage of the total weight". Forgetting that the addition of many seemingly insignificant items results in a large total weight, he proceeds, expecting to attain a light empty weight. Another factor is present that he is not aware of. This is the existence of the Phantom Weight Law (PWL). The Universal PWL states that "additional weight of 3 to 10 percent of the empty weight will sneak into an aircraft (usually at midnight when the lights are out) between the time the weight engineer is confident he has accounted for everything and the time the aircraft is rolled onto the scales. This Phantom weight will remain in the aircraft and grow, but will never be accounted for nor rationalized"

The biggest trap is the non-concern for each gram of additional weight. Example: a two-inch BID tape installed at two and a half inches wide - seems insignificant? Yes, but that part is 25 percent overweight. Using the next size electrical wire - seems insignificant? Yes, but that part is 25 percent overweight. A small knob that is 25 percent heavier than another, a 5 lb rather than a 4 lb seat cushion, etc. Note that acceptance of these kind of items throughout the building and outfitting can result in an aircraft more than 100 lb overweight!!

Patch Contest

Our patch/emblem contest (see CP 27) has been extended until June 10th. We'd like to get more entries. Try to submit something that is not complex and not with a lot of words. An easily-recognizable symbolic shape or shapes and the letters RAF or RUTAN. We want it to represent not just one of the various airplanes, but a general theme of our aircraft designs. Do submit an entry even if you have already sent one in. The more the better. We will try to get jacket patches made before Oshkosh '81 convention.

FLASH - The fifth Long-EZ to fly!! Max Bradley of North Dakota. Congratulations Max.

Oshkosh - Accommodations.

Nat Puffer provides the following report:
A formidable problem presented to the first time VariEze/Long-EZ pilot flying into Oshkosh, is where to stay. Even with Long-EZ baggage space, it is difficult to pack enough camping gear for a week. If you are fortunate enough to find a place in town, there is still the commuting problem.

There is a solution. Oshkosh Recreational Vehicles has offered to park all of the camping fold out trailers he can muster in Paul's Woods one week ahead of time to get a good spot, for VariEze/Long-EZ pilots for a mere $125.00 ($10.00 deposit required in advance). You will also have to pay the advance camping fee, even though the trailer is not occupied. These trailers sleep 6, (get together with friends to share the tariff) have heaters, stove, sink and ice box. If you can't carry the rest of your gear in your VariEze, build a lighter one!!
Contact:
Dick Welland,
3691 Fond du Lac Road,
Oshkosh, WI. 54901 (414)233-3298
Supply is limited, first come first serve.

International VariEze Hospitality Club
Fly in at Taos, New Mexico over the 4th of July weekend. Charles and Joan Richey (N13EZ) are the organizers and they report that they have 10 confirmed VariEze/Long-EZ and would like bunches more.

Chuck says it is not necessary to be an IVHC member, all interested parties may attend. Taos is in high country, a very beautiful area, should be a great weekend. Contact Chuck and Joan Richey for details.
600 S. Melendres,
Las Cruces, NM 88001 (505)523-1300

CAUTION
Never rotate the nose beyond the angle that places the canard on the horizon. **SKETCH OMITTED**

Carburetors for Long-EZs

Most 0-235 Lycoming engines come equipped with a Marvel Schebler carburetor without an accelerator pump. This carb is a MA3A and various configurations (10-xxxx numbers) are found. N26MS has a Marvel Schebler MA3A and the configuration number is 10-5199. This carb has no accelerator pump and we therefore have to use a primer to start the engine. A direct replacement for this carb with an accelerator pump would be a Marvel Schebler MA3PA - 10-5220. If you wish to order a brand new Lycoming engine from a Lycoming dealer we feel that probably the optimum engine for a Long-EZ is as follows:

Lycoming 0-235-L2C
Must have mechanical fuel pump.
Can not have spin-on oil filter,
instead must have standard oil
screen and housing.
Marvel Schebler MA3PA Carburetor
Part #10-5220.
No provision for primer required.
Must have Slick magnetos,
Bendix will not fit into the mount.

If you already have an 0-235 engine with the standard MA3A carb (no accelerator pump) you can use a primer, which works fine, or you can get an MA3PA. Various other 10-xxxx numbers can possibly be used. According to Avco Lycoming, the following numbers have all been used on 0-235 engines:

MA3PA	10-5257	Economy jets, slightly
	10-5220 E*	different at full rich
MA3PA	10-5267	
or	10-5220 EN*	Approx. 4% leaner
or	10-5257 N*	

* E, EN and N designate field modifications to these carburetors.

Accident

Letter from Alden Andrew, 24531 Vanessa Dr., Mission Viejo, CA

Dear Burt,

This note is to alert VariEze owners of problems that made me an ex-owner! I had the Brock fuel caps as specified in the plans. As per original instructions, a vent hole was drilled in the cap for the auxiliary fuselage tank. I did not modify the auxiliary cap with the aluminum tube as per CP 25 page 4.

Recently I removed the left main fuel cap and went to the restroom while the attendant put in the fuel. Upon my return, the left cap was on and the attendant was fueling the right main. I replaced the right cap and went flying. Shortly after take-off I was notified over the Unicom that fuel was being dumped overboard. Sure enough, the attendant had set the left cap on but had not engaged the Dzus fastener and I had neglected to check or notice that is was not secure. I landed immediately and discovered that the cap had hit the prop and left a gash 1/2" wide and 5/8" deep about 4" from the tip. After this experience I considered putting a tether chain on the fuel caps but

business matters soon consumed my full attention and the idea went by the wayside.

With a different prop, the plane was again serviceable. On February 6, over the telephone, I gave permission for a 3,000 hour pilot (with 10 hours in my VariEze) to use the plane the next day. Before his flight he attempted to obtain fuel but the fuel pit was temporarily out. Even so, they removed the left main cap as well as the auxiliary cap and attempted to obtain some fuel that might possibly be in the long hose of the fuel pit. After this unsuccessful attempt the caps were replaced (with the un-vented cap being put on the auxiliary tank) and it was decided that with about 1 3/4 gallons in the auxiliary tank that the pilot and his passenger could make Corona Airport from the present Chino location (about 5 minutes). They took off on the auxiliary tank and at about 100' at 105 knots they lost power. In the knowledge that there was fuel in the auxiliary tank the pilot did not try to select the mains which still had adequate fuel. An off airport landing (?) was made in a rough grassy field. The nose wheel was left retracted. (The aircraft was forced to the ground at high speed and high rate of sink because of a fence ahead.) The plane came to rest about 300 ft from the original touchdown point. The pilot escaped with scratches and bruised legs and toes but no broken bones. The passenger was not scratched or bruised at all. The plane did not fare so well; collapsed main gear, main center-section spar broken and ripped off with the left wing, canard ripped off, the total front end from the trailing edge of the canard was completely severed from the rest of the fuselage, as well as the top and bottom kevlar cowling was ruined. The prop was horizontal at the time of impact so the prop, spinner, hub extension and engine were undamaged as was most of the instruments. The canopy was unscratched.

To sum it up, I would recommend either a mandatory change to include a ram air vent leading to the auxiliary tank or the tethering of the fuel caps.

As my 86 delightful hours in the VariEze has spoiled me, I desire another canard pusher. I guess a Long-EZ is the next project. Does anyone want to but a good VariEze canopy and a 96 hour SMOH Continental O-200 complete with hub extension, prop and spinner?
Sincerely,
Alden Andrew.

RAF comment: The two VariEze plans changes in this newsletter are intended to prevent recurrence of Aldens accident. We have before considered tethering the fuel caps, but were concerned that major tank damage would be done by a cap flailing against the surface. Note that, as was explained in CP 13 page 5, loss of a wing cap on a VariEze will cause all fuel to be slowly drawn into one tank (and overboard if tanks are more than half full) and result in fuel starvation, requiring the selection of the fuselage tank to maintain engine operation. Loss of a cap on a Long-EZ does not effect engine operation due to its left/right isolation and pumped fuel system. Also, the Long-EZ's caps are outboard of the prop to eliminate prop damage should a cap not be secured.

BUILDER HINTS

Exhaust gaskets. It is an excellent idea to use blow-proof exhaust gaskets on your VariEze or Long-EZ or VariViggen. If you plan on installing cabin heat, blow proof exhaust gaskets should be considered mandatory. These are available from Aircraft Spruce or Wicks Aircraft, and for your small Continental engine order part nbr 627429, for all Lycoming engines order part nbr 77611.

Long-EZ. Method to lap outside skin plies at bottom CL fuselage to avoid a bump.

DRAWING OMITTED

Aileron Hinge Pins.

Long-EZ and VariEze aileron hinge pins. The piano-hinge pins have in some cases been wearing out much more rapidly than they should. This is characterized by evidence of aluminum stain aft of the hinge on the aileron surface and excessive hinge free-play. The wear is caused by vibration of the hinge and can be eliminated if the pin is snubbed to prevent rattle. For new construction, before final installation of the hinge pins, bend them into a gentle "S" shape. This will ensure that they don't rattle in the hinge. A rattling loose hinge pin will cause excess wear to both pins and hinges.

DRAWING OMITTED

Back Seat Thigh Support.

This little item really makes a difference to back seat comfort. This position works excellently for people from 5'4" to 6'4". Fabricate from R45 foam with 1 ply BID on each side. 1 pc. 4" x 19", 1 pc. 7" 19".

SKETCH OMITTED

Hints from builder.
1) It will save time in building and finishing if you are neat in everything you do. For example, protect foam and finished parts from slopping or dripping epoxy on them. Example, when laying up spar caps, do like a surgeon and cover and tape off adjacent foam areas to protect them from epoxy. **SKETCH OMITTED**

In a similar fashion, protect finished parts by covering and taping them against drips, runs etc.

2) When gluing foam cores together, use minimum micro to prevent large excess from oozing out. Tape edges of cores first, so you can clean off excess without smearing it across the foam. **SKETCHES OMITTED**

3) Before sanding cores, undercut seams to avoid high spots, or breaking loose micro or 5 minute epoxy which will damage foam. Its easy to fill undercut areas again before skinning.

Long-EZ - Prop Position

The forward face of the prop hub should be at F.S. 158.8" and at W.L. 21.83. This includes the recommended 3" prop extension.

Long-EZ Main Gear

When drilling the 5/8" diameter holes through the main gear attach tabs, the 5/8" counter-bore tool drills a slightly undersized hole in the fiberglass laminate. An easy way to get this hole to fit the LMGA tube is to use a dremel sanding drum. Do not use it in a dremel tool, rather chuck it up in your 1/4" power drill (much slower rpm) and it will make the hole a perfect fit on the tube.

Clarification, Page 5-2 Long-EZ

A couple of builders have been confused at where to install the 3-ply UND stiffeners on the top insides of the fuselage sides. (page 5-2 step 2). The adjacent sketch will clarify this.

SKETCH OMITTED

Cowling storage

When you get your cowling you may not be ready to use it right away, in fact some builders store cowling for months, occasionally years! A cowling left laying around can change shape considerably. For easy fitting when you need it, clamp both cowl halves as shown to a length of 2" x 4" lumber. This holds the cowl in the correct shape to prevent long-term warping. **SKETCH OMITTED**

Wherever you have a glass-to-glass laminate (trailing edge of wings, winglets, canard etc.) do not leave the overlapped skins unsymmetrical. Always clean up the edges (see sketch) to a smooth surface without a joggle. It is poor practice to leave areas joggled even during construction, since a blow on the untrimmed edge can result in delamination. **SKETCH OMITTED**

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder, giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

CATEGORY	DEFINITION
MAN-GRD	MANDATORY, GROUND THE AIRCRAFT. DO NOT FLY UNTIL THE CHANGE HAS BEEN ACCOMPLISHED.
MAN-XXHR	MANDATORY, ACCOMPLISH THE CHANGE AT NEXT CONVENIENT MAINTENANCE INTERVAL OR WITHIN XX FLIGHT HOURS, WHICHEVER COMES FIRST.
DES	DESIRED - STRONGLY RECOMMENDED BUT NOT REQUIRING GROUNDING OF THE AIRCRAFT.
OPT	OPTIONAL - DOES NOT EFFECT FLIGHT SAFETY.
OBS	OBSOLETED BY A LATER CHANGE
MEO	MINOR ERROR OR OMISSION.

Long-EZ Plans changes

LPC #54, MEO
Page 24-1 Step 1, 3rd paragraph, glass with one ply of BID.

LPC #55, MEO
Bill of Materials Page 2-2 AN970-4 Washers, should be 11 not 5.

LPC #56, MAN GRD
Clarification CP #25 Page 6 Lower right corner. Long-EZ spar cap thickness. This box must be complied with. Several builders have ignored this. Do not omit this, you must have the prescribed amount of glass in the spar caps, in both the centersection spar and the wings.

LPC #57, MEO. Page 3-23, Number 6. Wet out
Delete this paragraph entirely and add the following: WET OUT - Squeegee cloth from center outward aligning the the fibers straight and removing wrinkles. Pull the outside edges to straighten any wrinkles. Brush or stipple epoxy into any dry areas or pour on additional epoxy and squeegee out uniformly. Check for excess epoxy "ridge" with the squeegee. (page 3-11).

LPC #58, MEO. Page A5.
On the main gear mounting pads bottom of page, two places shows only 1 ply. Should be 15 plies of BID.

LPC #59, MEO. Page 21-6, section F-F.
The outside strips of UND glass, the third ply in layup #7 and #9 (shown on Page 21-4) has been omitted. This should be shown on Section F-F (on the outside of the tanks, directly above layup #4 directly below #3).

LPC #60, MEO. Page 21-3 Fifth paragraph.
1/4 - 27 NTP should be 1/8 - 27 NTP

LPC #61, MEO.
Section IIL, Lycoming Engine Installation, bill of materials Page 37.
Engine mount hardware - under 8 #71032 rubber bushings, add: OR 8

#6083 rubber bushings. This choice will depend on the size hole machined into your engine.#71032 for 1" diameter hole and #6083 for 7/8" diameter hole.

LPC #62, MEO.
Long-EZ Owners Manual Page 24. Add maximum landing brake extension speed - 95 kts.

LPC #63, MEO
Section IIC, Lycoming Engine Installation Page 3. Third paragraph on the right. MA3-SPA should be MA3-PA.

LPC #64, DES. Page 19-17
Snub the aileron hinge pins per instructions in this newsletter.

VARIEZE PLANS CHANGES

Owners Manual, Page 55
Checklist, after "fuel caps on" add "and locked - screws aligned to locked orientation".

CP #24, page 6
First Plans change. Delete "DES". Replace with "MAN-GRD".

Shopping

B & T Props, 8746 Ventura Avenue, Ventura, CA 93001.
Reports that they are really getting busy and asks that anyone wanting a prop to please order at least three months ahead of time.

Aircraft Spruce reports that they now have in stock the following items:
Light weight electric turn coordinators (as used in N79RA).
Spray-Latt (peel-coat type canopy protection).
Zolatone "Splatter" paint for interior (as used in N26MS).

Wicks Aircraft Supply and Aircraft Spruce report that they now have the Welen "single" flash wingtip lights, strobes and power supplies as per Long-EZ plans.

Lycoming 0-235-L2C with fuel pump.
Contact: Howard Libersky, (305)464-6020

Continental 0-200A engine zero time. (two of)
Contact: Rudolph Spremich
520 Torquoise St.
New Orleans, LA 70124

Original VariEze maingear strut - $250.00
Contact: Herman J. Kuebler
5109 Falconwood Ct.
Norcross, GA 30071

Decorative leaded glass window hanger. (16" wingspan VariEze planform). $20.00 plus shipping (California residents add 6% tax).
Contact: Kathy Ganzer
343 S. Mollison Avenue #14

El Cajon, CA 92020

VariEze dust cover as seen on Herb Sander's VariEze at Oshkosh, (N70VE). Excellent quality, covers the entire airplane $129.00.

Contact: Herb Sanders
P.O. Box 18690
Memphis, TN 38118
(901)365-7606

Jim Witt, 6200 East M-21, Corunna, MI 48817, (517)743-5076
Jim makes very nice tie tacs, charms, pendants of your N number, for example N79RA. This is made out of gold or silver to your specification. Largest possible size is 4". Jim charges $50.00 for his labor plus the price of the precious metal used.

Advanced Composite Lightweight Cowlings

We announced the availability of these cowlings in CP #27 page 5. Unfortunately the supply of graphite woven cloth has since become much more difficult to obtain and almost twice the price. This means that we have had to turn to Kevlar cloth. Any builder ordering a graphite cowl, should be aware that unless he gets an early one, he probably will receive a Kevlar cowl. It is within 1 lb. of the weight of the carbon cowls. The Kevlar cloth is covered, both inside and out with fiberglass, to avoid the sanding/fraying problems experienced with Kevlar. We have approved the use of Kevlar in the cowlings, in fact we have one on display here in Mojave for inspection.

Aircraft Spruce or Wicks Aircraft supplied Wheel Pants

These wheel pants for VariEze/Long-EZ 3.40 x 5 tires should be available by the time you read this. Those for 500 x 5 tires will be available in a month.

The correct method of installing these wheel pants is as follows: Install 11 K100-3 nut plates in the flanges, evenly spaced. Drill and countersink #10 holes for AN509-10R8 screws. Jig the pant halves loosely in place and carefully mark the top for the gear leg cutout. Cut this out and reposition the pant, making sure it clears the brake caliper and that the incidence is correct. It is best to have the pant about 3 to 4 degrees nose down. Be certain to leave a 1/10" clearance around the brake line to avoid a brake leak due to the pant chaffing on the line.

Now, fabricate an aluminum bracket from .032" 2024T3 approximately 2.5" x 8", see sketch. This bracket mounts on the four axle mounting bolts in a horizontal position. Install two nut plates (K1000-3) in each bracket, and bend the bracket as shown to extend inboard one inch. Drill two #10 holes in the pant to match the bracket. Drill and tap the axle 1/4 x 28 (use a #3 drill). Now cut out 3 pieces of your 1/4" plywood (firewall bulkhead) and glue them together to make one piece 3/4" thick x 2" x 2". This piece should be pyramid shaped and should have an AN970-4 washer on top of the pyramid. Layup 2 plies of BID over this washer and plywood block lapping at least 1/2" all around

onto the inside of the wheel pants. After this cures, drill a 1/4" hole through the center of the washer, and you should be able to mount the pant nice and firmly to the gear leg/axle. Use low profile AN525 screws for low drag. **SKETCH OMITTED**

Pre-Fab Fuel/Baggage Strakes for Long-EZ

Fuel/baggage strakes will be available by June. These will consist of 4 large pieces (2 tops and 2 bottoms) vacuum bagged into excellent molds. The pieces join at a leading edge joggle joint, eliminating the TLE/BLE pieces, and they extend to match the wing. Installation drawings for these tanks will be provided.

These components will be sold direct by the manufacturer.

Contact: Task Research
848 East Santa Maria Street
Santa Paula Airport
Santa Paula, CA 93060
(805)525-4445

Contact them for price and availability.

Questions and Answers

Q. Can I make a soft leather "boot" to cover the control sticks, in place of the fiberglass cosmetic covers shown?
A. Yes, we have seen several examples of this, and they looked excellent. The leather can be attached with contact cement or velcro. There must be no restriction to control stick travel.

Q. How noisy is it in a Long-EZ?
A. We ran a comparison with a Cessna 150 and a Long-EZ.

	Long-EZ	C-150
Taxi	82 dba	78 dba
Takeoff and climb	96 dba	92 dba
High Cruise	98 dba	91 dba
Low Cruise	94 dba	88 dba

Q. Can I use a voice actuated intercom?
A. Yes, we heartily recommend doing this, and also using good noise attenuating headsets. This makes conversation between pilot and passenger varieze, and also enhances your ability to hear and understand ground controllers. Cockpit speakers should not be used in VariEze's and Long-EZ's. With good headsets (we use David Clark H10 type), the pilot-perceived noise level is considerably quieter than in a Cessna without headsets.

Q. Can I move my B.L. 45 rib outboard in my Long-EZ fuel tank in order to carry more fuel?
A. Absolutely not. This will give you an aft c.g. condition, even with a small quantity of fuel on board. Long-EZ's should have enough fuel/range to satisfy anyone.

Q. Why is my L.B. 12345 weldment from Brock, for my landing brake 1" too short?
A. It is not too short. You missed the instruction on page 9-1 and CP #26 page 6, LPC #35, to go to page 24-1, step 2, where you will find this called out. The reason is that this weldment was made for

VariEzes originally, and they are 2" narrower at this point. Rather than make a new part, we accepted mounting the L.B. 18 brackets 1" left of center on the landing brake. We have tested it in this configuration and it works excellently.

Q. Can I substitute a Stewart Warner #8406J oil cooler for the recommended Harrison #8526250?
A. Yes.

Q. I want to install the NACA inlet. Can I do it before glassing the bottom of the fuselage?
A. No. The normal glass on the bottom of the fuselage is required structure. The NACA inlet per Tim Gehres and Steve Wood's plans is purely an inlet-shape add on, and provides no structural tie between the bottom longerons.

VariViggen News by Mike Melvill.

Arthur Schwartz has accumulated some 42 hours and has had the initial restrictions lifted. He flew down the coast under the NY. TCA to Dover, Delaware, where he met George Semac. George's VariViggen is at the airport, and has been signed off for flight, so we will soon have another Viggen in the air. We have heard, second hand, of yet another Viggen at Redding, Pa. Apparently this airplane is doing taxi tests. Unfortunately I do not have this builder's name.

George Craig sent in a few excellent photos of some of the detail work he is doing on his VariViggen. (see page __) George has built the worm/wormgear main gear retract system, as used in my N27MS, and his workmanship looks great. George has spent a lot of time and effort designing neat little features to make future maintenance easier. A work of caution here: It is really easy to fall into a trap. You figure, heck, this little modification will only weigh a 1/4 lb. more, but the problem is it will sneak up on you. When you finally weigh the airplane, it can really be a shock. When I weighed N27MS I was stunned to find it weighed 1252 lbs. Burt's N27VV, the original prototype only weighed 1070 lbs. This made mine almost 200 lbs. heavier. This means I fly even solo, as though I had a 182 lbs passenger on board, and it really shows up on a hot day at high altitude. Actually I would give an awful lot to have my Viggen weigh 100 or 150 lbs less. Remember, the weight buildup takes place in the finishing area, after basic structure is done. Usually a builder gets the airframe structure done with little difference in the weight, and then he puts instruments in the back, map reading lights front and back, sound proofing, upholstery, wall to wall carpeting, etc., and before you know it, you have ruined the utility of your aircraft.

George is building his Viggen as a "stand-off" F14 Tomcat replica. He had built fiberglass seat frames to simulate ejection seats. A military paint job would really look impressive. I cone suggested something along this line for my Viggen, but I was immediately and strongly overridden by my wife Sally!!

Frank Tomko has requested clarification on a couple of items and I thought maybe answering them here instead of in a letter would help other builders. He asked where the hole should be cut through the firewall (F152) for the wiring bundle and for the throttle, carb heat and mixture cables. The best place I found for the wiring bundle is at B.L. 7.5 and W.L. 15.5. A 1" diameter hole accommodates all wiring necessary. The wiring bundle could be supported with a rubber grommet or RTV silicone. Either way, precautions must be taken to ensure that the wiring is not chaffed by the stainless steel firewall. The throttle, carb. heat, and mixture control cables can go through the firewall at B.L. 7.5 and W.L. 14. Again a 1" diameter hole with a rubber grommet works fine.

Ken Winger of Tulsa, Ok. reports that he will be at Oshkosh this year. Ken has his Viggen through silver at this time, so he is getting close. Ken's Viggen has a Lycoming O-360 (180 hp) and SP wings, and he has really tried for light weight structure. Should be a performing airplane.

N27MS continues to run well, and we do fly it virtually every Saturday here at RAF for demonstration purposes. Of course it will go to Watsonville and Oshkosh at least and possibly other flyins. Maintenance has been minimal, the hour meter quit metering and had to be replaced. Apart from oil changes and putting gas in it, she has been running like a top.

Jim Cavis has written to say that he is giving up on his Viggen. Jim has lost his medical due to an eye problem, and has elected to sell his project as is. We do not normally advertise airplanes in the CP, but we are very familiar with Jim's Viggen. Jim reports that it is about 90% completed and that he has most parts necessary to complete it. Jim's project is a standard wing (foam/fiberglass) 180 hp Viggen. Contact Jim for further information -

Jim Cavis
4921 N 86th Street
Scottsdale, AZ 85251
(602) 945-0430

Instrument Panel on Mike and Sally's Long-EZ N26MS
PHOTOGRAPH AND LEGEND OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

VariEze by Dick Cutler with Long-EZ main gear. Note the soft type luggage.

Swiss VariEze undergoes a wing static-load test.

Twin EZs by Don Prestin and Don Young of Santa Rosa, CA. You have to see this in color to appreciate the 'class' of these two together!

RAF-designed AD-1 at NASA. The variable skew AD-1 is parked beside a variable-sweep F-111. AD-1 project pilot Tom Mcmurtry - photo was taken just after the shuttle landed at Edwards.

N79RA and N26MS. Two 'Longs' out on a rare day that clouds visit our Desert.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

George Craig's instrument panel layout. George's workmanship is excellent. **VariViggen**

George Craig's nose gear retract system: Note bearing support for drive shaft, an excellent idea. **VariViggen**

George Craig's main gear worm/wormgear assembly with universal. **VariViggen**

George Craig's nose gear retract/extension motor and reduction gear. **VariViggen**

George Craig's nose gear. Gear up micro switch is top center. Easier access. **VariViggen**

George Craig's main gear motor and gear box. Note manual override gear and shaft in the foreground. **VariViggen**

Wayne Wilkin's homebuilt nose gear fork and pivot. Wayne says it weighs the same as the Scott tail wheel assembly. **VariViggen**

Wayne Wilkin's interior of right inboard wing, looking aft at spar 'E'. **VariViggen**

LONG-EZ

FAST - EFFICIENT - HIGH UTILITY - LONG RANGE

Long-EZ N79RA with 75 gal. back seat tank during the world distance record flight. **PHOTO OMITTED

THE AIRPLANE
The Long-EZ is a small, high-performance, high-utility homebuilt sportplane. While recommended mainly for Day-VFR operation, competent pilots can also equip it for night and IFR flying. Power plant is either the 0-235 Lycoming or the 0-200 Continental. It has an alternator-powered electrical system and can be equipped with electric engine starter. It's cockpit layout is designed to compliment pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and

headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wing strakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 P.V. core foam. (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal or wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

TRAVELLING MACHINE

At last, an airplane that is specifically developed for efficient, high speed, long-range travelling with room for two adults and plenty of baggage. Fuel allowance with two adults is 38 gallons. Single-place, you can carry 52 gallons! If you're in a hurry, you can cruise at 75% power at 8000 ft at 185 mph (161kts), burning 6.51 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles), in 5.2 hours with a 40 minute fuel reserve. If you're not in a hurry, you can cruise "economy" at 12000 feet at 144 mph (125 kts), burning only 3.52 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 10 hours with a 40-minute fuel reserve. Single place, using the entire 52-gallon fuel capacity, stretches the maximum range and endurance to over 2000 miles and 16 hours!

The high efficiency, long-range capability increases a pilots options for fuel availability and weather detours. The fact that the Long-EZ can carry the same load and fly as fast as other 160-180 horsepower aircraft, means large fuel savings - 29 mpg at fast cruise, 41 mpg at economy cruise.

UNUSUAL EFFICIENCY

The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a worlds distance record, and landing with enough fuel to surpass 5000 miles. At that, it's capability was not taxed - it's initial climb rate was over 600 ft/mn! At light weight, it climbed to 27000 ft in still air - an altitude unheard of for a fixed-pitch, non-turbocharged airplane. Our Long-EZ is so efficient, the engine can be shut down while at 5-ft altitude over the numbers at only 120 knots, then it can pull up, fly at 360 degrees pattern and land on the same runway - completely without power! It's power-off glide angle is only 3.7 degrees - thus a belly-mounted drag devise (landing brake) is used for landings.

SUPERB FLYING QUALITIES

Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and safe stall characteristics. It can be maneuvered sharply, even to full aft stick, without fear of stall or spin. Flight tests show the prototype to be free from stall departures and spins for all types of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed.

Trim changes due to power, gear retraction or landing brake are all very small. It's wide cg range allows a large range of pilots or passengers weighing up to 240 lbs.

The Long-EZ's approach and landing speeds are 75 mph (65 kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.

THE HOMEBUILDER SUPPORT
The Homebuilder support. The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

THE TEST PROGRAM
The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

COST AND BUILDING TIME
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, VFR instruments, plumbing, tools, tires, wheels, brakes and upholstery (cushions and special suitcases) costs about $2,900. Any of these items can be purchased separately. We strongly recommend that you get the distributor's catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

The S-glass roving molded structural fiberglass main gear and nose gear are available from RAF, at $277.95 and $49.75 respectively. Many other prefab parts ranging from propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased from the listed manufactures. All those prefab parts cost approximately $1,600 - and using them, the competent builder can build a Long-EZ in as little as 800 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above cost of the prefab items. Contact the

manufactures for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

Engine costs vary widely. Our prototype has an 0-235 Lycoming that had 1400 hours, when purchased for $1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from $3000 to $6000. Engine accessories, such as instruments, prop extensions etc cost about $300 to $500. In summary then, total cost can run from $5300 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $9900 for everything available purchased and a zero-time engine. IFR avionics can add from $2000 to $15,000 to those numbers, with many options available.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.
Empty Basic	710 lb.
Empty Equipped	750 lb.
Solo Weight	960 lb
Gross Weight	1325 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	550/830 ft
Climb (solo/gross)	1750/1350 fpm
Cruise 75% 8000 ft	183 mph
Cruise 40% 12000 ft	144 mph
Max range * 75% (solo/2 place)	1370/965 mi
Max range * 40% (solo/2 place)	2010/1430 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200

SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order. Newsletter not taxable.		
TOTAL		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $3

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $3

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Sally Melvill taxiing out for first Long-EZ solo flight.

Long-EZ parked nose-down with two VariEzes.

The nose gear retracts for parking and in flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

THE CANARD PUSHER NO 29 JULY 81

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 29. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 29. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 29. If you are building a VariEze from 2nd Edition plans you must have newsletter 16 through 29. If you are building a Long-EZ from 1st Edition plans you must have newsletter 24 through 29.

A Current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave CA., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins. When arriving at Mojave by car turn east at the Carls Jr restaurant to find the airport.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed your reply.

RAF is very pleased to announce the addition of Larry Lombard. Larry joined us in May 1981. Larry built and currently flies his own VariEze N15LL (see photo) and has been involved in the building of several VariEzes in the Sacramento area. Larry will be heavily involved with the self launching sailplane development and building, as announced in CP 28. **PHOTO OMITTED**

RAF Activity lately has involved aerodynamic development of our self-launch sailplane design, research on composite component assembly methods and structural arrangements, design support for a new twin-jet research aircraft being built for a major aerospace company, builder support and the Cafe 250 participation.

Canard Pushers from 1 to 82

CAFE 250 - The first Competition in Aircraft Fuel Efficiency race was held last month in Santa Rosa, CA. It was well attended, with 27 commercial and 20 experimental aircraft. This is the most extensive fuel efficiency competition ever run for general aviation aircraft. It is not an all-out miles-per-gallon race, but one whose best result is obtained at about 65% power. The fuel efficiency factor is calculated as follows:

FEF = speed x mpg x square root of payload

Where speed is in mph, mpg is statute miles per US gallon and payload can be up to 200 lbs. per seat, but not to go over gross weight.

While a VariEze can attain an FEF or 140,000 + in level flight at altitude, it's scores were under 100,000 on the race course when faced with winds, required climbs and descents, time in the pattern and fuel to taxi.

The competition is very interesting technically and a lot of fun to fly. The official placings are listed below. It should be noted that the placings for the small efficient aircraft may be in error due to the inability to accurately determine the small amount of fuel used by weighing the entire aircraft.

For example, aircraft weighing inaccuracies on only 2.4 lbs. per weighing (0.8 lbs. per scale) would have swapped the first place and third place aircraft's positions. Variations within the weighing scale resolution (0.5 lbs.) would drastically change the FEF of a Quickie. The Long-EZ that placed 17th appeared to place 5th if fuel used was based on sight gage and totalizer readings. Race officials are planning to minimize these variations next year with methods to more accurately measure fuel burned.

PLACE	AIRCRAFT	PLACE	AIRCRAFT
1	Q2	25	CESSNA T210
2	QUICKIE	26	CHEROKEE 180
3	VARIEZE	27	GRUM TIGER
4	QUICKIE	28	FORMULA I RACER
5	VARIEZE	29	ROCKWELL 112
6	GLASAIR	30	TWIN COMANCHE
7	VARIEZE	31	CESSNA 182
8	VARIEZE	32	CESSNA 172
9	VARIEZE	33	PIPER PACER
10	MODIF BONANZA	34	AZTEC
11	MODIF MUSTANG	35	CHEROKEE
12	QUICKIE	36	CESSNA 175
13	LONG-EZ	37	CESSNA T206
14	MOONEY (DISQUAL)	38	CESSNA 172
15	MOONEY 201	39	WING DERRINGER
16	POWELL SPECIAL	40	CESSNA AIRMASTER
17	LONG-EZ	41	CESSNA 175
18	RV-4	42	CESSNA 172
19	MOONEY 201	43	PIPER PA-11
20	LINNMING MUSTANG	44	CESSNA 310
21	DEFIANT	45	BELLANCA 14-13
22	COMANCHE	46	CHEROKEE
23	BUSHBY MUSTANG II	47	BELLANCA 14-13
24	KR-1 (DISQUAL)		

Note that the top 9 winners were fiberglass aircraft, and the top 5 did not have a horizontal tail! The Q2 won the experimental trophy. The modified Bonanza that won the commercial trophy had won the Paris - New York - Paris race two weeks before. The Defiant won the best twin trophy, beating also all the commercial singles except the Bonanza and Mooney 201.

Pilots in the race flying RAF aircraft were:

Jeana Yeager	N26M	(Mike & Sally's Long)
Mike Melvill	N4EZ	(Prototype VariEze)
Larry Lombard	N15LL	(The winning VariEze 3rd overall)
Dick Rutan	N79RA	(Prototype Long-EZ)
Burt Rutan	N78RA	(Defiant - Pat Storch navigator)

Sally Melvill had planned to fly N26MS but was unable to attend.

WORLD DISTANCE RECORD - Dick Rutan

Another World Class distance record now belongs to the Long-EZ. 4563.35 miles straight line distance in C1B (1000kg) is the new record subject to ratification by the FAI. That is the great circle distance between Anchorage, Alaska and Grand Turk Island in the British West Indies near Puerto Rico. The flight time was 30.08. The total fuel burn was 142 gallons, that works out to 151.4 average ground speed and 4.71 gph. We used only 1.8 qts. of oil.

We found the logistics of getting the aircraft (N169SH) to Alaska and recovering it back home was quite an undertaking. We departed for Alaska on May 22 and got

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back to Mojave on June 13. Most of the time was spent waiting for favorable winds at Anchorage. For a while it looked like we should have started in Puerto Rico and flown to Alaska. But after waiting 14 days the Weather God pushed a high pressure ridge out of the Gulf of Alaska that gave us some tail wind over Southern Canada and the Northern mid U.S.A. But the rest of the route was a no-help cross wind to a light head wind in Alaska and over the Atlantic. The over all wind factor was only +6 knots.

I flew at between 12 - 13 thousand feet and averaged 153 mph true airspeed. The reason that does not compute is because the actual airway distance was 4690 sm and the route time was 29.5 hours. When I got to Grand Turk I was feeling good and had plenty of fuel so just flew around long enough to log over 30 hours! I landed with 6 gallons fuel, enough for another 200 miles but the next over-water leg was 363 miles so Grand Turk was where it had to be.

Luckily for me I had none of the fatigue problems I had on the 33.6 hour closed-course record flight. I was in better physical shape and was well rested before take-off. Also one big factor was all the adrenaline pumped into my system during the night-long weather system I flew through on only a turn and bank gyro after my vacuum pump failed. It did get a little uncomfortable during the last part of the flight because I had on a lot of arctic clothing. It was quite a difference

from my 4 a.m. Alaska take-off to the mid-afternoon Caribbean tropical hot-humid weather! Latitude change for the flight was 40 degrees, longitude changed 79 degrees.

We are a little disappointed that we did not make 5000 miles. We were short because we just could not find any more room for fuel inside the aircraft, the lack of good tail winds and the time spent at low altitude punching through the weather. Also, the bigger 0-320 engine used more fuel than Burt's 0-235 Long-EZ. The weight limit in the class was 2204 lbs and my gross weight at take-off was only 2033 lbs. I could have handled the 2200 lbs. easily. The take off roll was only 2800 ft. and at a stabilized climb speed of 140 mph indicated I had an initial climb of 600 fpm.

When I did the closed-course record in the prototype Long, I had used a cable between the main gear axles to prevent excessive gear spread because the prototype had an early, more flexible gear. My Long has the standard main gear like all the homebuilt Longs, and it did not need any additional support. The wheel camber was only slightly outward at my take off weight of 2033 lbs.

All in all we are happy with what we got. Next is the world altitude record and some of the long-distance speed records. Most are within EZ reach of the Long. I would like to see more homebuilders involved in breaking some of the records. It is not that complicated and the challenge is a lot of fun.

LBF RACE - Oshkosh 81
RAF plans to offer prizes to the first two VariEze/Long-EZ finishers in the Baker competition. (fuel corrected speed).

HOSPITALITY CLUB FLYIN
Taos, New Mexico. Chuck and Joan Richey have organized this flyin and at press time they have 22 VariEze and Long-EZs and 39 people signed up! Looks like this should be another super flyin. Rafting trips on the Rio Grande are also available. Builders and flyers are coming from as far away as Minnesota, CA, Utah and Texas.

COLOR OF COMPOSITE AIRCRAFT
In spite of a number of composite airplanes showing up around the country with various color schemes, RAF does not approve any color but white. Trim colors must be limited to the vertical surfaces. Do not paint a dark stripe on the top of the wing. Since the introduction of the European glass sailplanes in 1961/62, there have been no cases of the composite sailplanes having any damage from heat, and all of them are white. They cannot be certificated if painted any other color.

There can be no doubt that a dark color will reduce the useful life of your airplane in the long-term, and could lead to even more serious consequences should the structure get too hot. White guarantees that your airplane will never go above about 10 degrees ambient air temperature.

The colors, even the lighter and metallic ones can get hot enough in desert ambient conditions to seriously weaken the epoxy matrix and degrade the foam core. Measurements taken at Mojave of several

airplanes and trim stripes have shown the following results using a surface pyrometer.

Ambient	105 F
White (different shades)	110 F to 116 F
Light Yellow	128 F
Grey	135 F
Light Blue	130 F
Dark Blue	168 F
Dark Red	165 F
Dark Green	175 F

FULL-CORE COMPOSITE SANDWICH WINGS
RAF pioneered the structural method of using the hot-wire styro block to form full-depth foam core wings in 1974. We have built over 60 flight-hardware flying surfaces using this method in the development of the S.P. VariViggen, VariEze, Quickie, Defiant, Long-EZ, AD-1 and other aircraft.

The method has since been used on other types, including an STC'ed vertical fin for the older Mooneys. It is estimated that approximately 500 full-core aircraft are now flying, logging over 100,000 flying hours.

The major advantages of full-core are the ease of moldless construction, the accurate contour maintenance under airloads, and elimination of moisture traps. Critics have claimed that full-core is heavier than the hollow wing with standard skins. Our analysis has shown the weights to be very close. However, we have built and tested wings designed to the same criterias (hollow vs. full core) and have found the hollow wings to be heavier. In addition, the hollow structural configuration is more susceptible to workmanship errors that can result in structural failure. This is due to the presence of peel loads and blind rib closeouts. In addition, the hollow structure flexes, has more points of concentrated stress and is more prone to catastrophic failure should a joint open up (leading or trailing edge).

A builder who had built a VariEze, Quickie, Long-EZ and Adventure is now building a homebuilt with molded wing skins. He reports that despite the large molded parts, the man hours in the wing are at least 50% more than for both full-core Long-EZ wings. This is due to the many ribs, jigs, control system parts etc.

RETRACTION!
Regretfully we received incorrect information on Max Bradley's Long-EZ as reported in CP 28 Page 6. This aircraft has not flown and is currently only about 80% complete.

The fifth Long-EZ to fly belongs to Richard Sparkman of Maples, Florida. Richard has 8 hours on it at press time and is currently working out an over rich carburetor. Richard is planning on being at Oshkosh. His airplane is full IFR equipped. Congratulations Richard!!

RAF Patch Competition!
At long last we have a winner. Congratulations to Chet Rhamstine of Mt. Clemens, Michigan. We are not printing a copy of the patch that

Chet designed as we feel that once it is sewn it will look a lot better than just a copy. We hope to have the patches available for Oshkosh.

Warning - Loss of Prop!
Dick recently had an experience with his Long-EZ that would raise the hair of the most experienced pilot. He lost the entire prop and spinner while cruising at 10,000 ft. over a solid cloud deck. After watching the prop cascade away he received radar vectors from center to allow a successful approach to an airport, under weather conditions of 1/4 mile visibility in fog. Investigation revealed that the all-important bolt tension (required to transmit torque through faceplate friction) had been lost when the prop dried out in desert conditions after exposure to the humid-wet Caribbean climate at his world-record arrival location. Note the added caution in the plans-change section of the newsletter. Also, do not, do not exceed the recommended interval on prop bolt torque check. (Owners Manual, Appendix III).

ACCIDENTS
Power Loss - A south eastern VariEze crashed into trees after power loss on its first flight. The power plant was a conversion of a Chevy Corvair automobile engine. The aircraft was destroyed. The pilot was not injured.

Known Icing conditions/fuel management - A Midwest VariEze pilot began an extensive trip in IFR and icing conditions. His flight was a classic condition of many things going wrong in combination. He reluctantly accepted an altitude assignment in known icing conditions, only 1,000 ft. above the MEA. The pilot became quite busy as ice was building, switching the single Nav to identify intersections then noting an impending failure of the gyro horizon - nose high at normal airspeed. Also, he reported a Nav problem and center lost radar track of him. They were talking to him but did not know his position. At 40 minutes from takeoff the engine abruptly quit cold. He descended through the clouds breaking out at about 500 ft. AGL and put it in a freshly plowed field approximately 30 miles off course, carrying a large amount of airframe ice. The pilot received a fractured vertebra. The aircraft's wing, belly, landing gear and canopy received major damage. Investigators found the fuselage tank empty, speculating that the pilot had departed on the fuselage tank and the engine failed due to fuel exhaustion. Probably the pitot-tube had iced up resulting in his thinking the speed was ok and the gyro horizon was failing. His airspeed was thus too low to allow a restart even when main fuel was selected during the power-off descent through the clouds (windmilling not maintained).

Many builders, including this one, have modified the positioning of the fuel valve on the VariEze, defeating its feature of reminding the pilot (by interference with his right wrist) that the fuselage tank was selected. There have now been two accidents caused by a combination of incorrect fuel management and defeating the interference design feature of the valve handle.

ACCIDENT ANALYSIS

As you know from reading the Canard Pusher, we report a synopsis of each accident and make recommendations to builders/operators on any item we feel should be changed or emphasized to decrease the probability of reoccurrence. We have reviewed the data available and have found one factor that is significant. A high percentage of the accidents (minor and serious) have occurred within the first few flights after a new owner has bought the airplane from a previous owner. Statistically, you are far more likely to have an accident flying a homebuilt built by someone else. This is true for experimentals, not just for VariEzes. For example, an all-metal type that recently was grounded for a series of structural failures - all the failures occurred after non-builders had bought the airplanes.

The factor may be a combination of inadequate familiarity with the airframe and systems, inadequate checkout and inadequate transmittal of documentation. Putting things in perspective, it is important to note that the builder is an aircraft manufacturer. As such, he may be responsible to a buyer for the quality of the machine and for properly educating the buyer in it's safe use and the extent of his flight test program. We at RAF provide builder support to our customers - those who may need assistance or have questions on how to interpret the plans to build or how to interpret the Owners Manual to fly the completed aircraft. But, if you sell your airplane to another person you cannot expect that we can support him. He must go to you, the aircraft manufacturer. For example, if he needs to do a fiberglass repair, but does not have the plans and educational material he will not know how to do the job. He needs to get that information and documentation from the manufacturer.

Homebuilt accident record statistics were reported for a three year period by The Aviation Consumer last year. They show an overall accident rate for VariEze of 2.59 (1.55 fatal) per 100 aircraft during the 3 years. Average for all homebuilt aircraft was 3.93 (1.07 fatal). We are not happy with this result, as we had expected the VariEze to be significantly better than the average homebuilt due to it's strong structure and good stall characteristics. Structurally the fiberglass VariEze has a perfect record - no inflight airframe failures in 100,000 flight hours. Also, there have been no fires either in operation or due to accident impact.

Data published by one source show that flying amateur-built aircraft is statistically a very risky sport, with an accident rate (per individual) higher than that for racing cars.

LONG-EZ FUEL SYSTEM

Do not change the fuel system. This system was carefully and thoroughly flight tested at all attitudes, and works very well as per plans. Several builders have asked if they could convert the fuel system to a "both on" situation. Absolutely not! Both fuel tanks feeding the carb together will only work on a gravity system. The Long-EZ does not have enough fuel "head" to use a gravity system. Therefore we use a pumped system. That is, the primary pump is a mechanical, engine driven pump, backed up by an electrical boost pump. This is similar to most low wing airplanes, Grumman Tigers, Cherokees etc.

If you try to pump fuel out of two tanks at the same time, it can draw from one tank only, until it is dry then you will get air, and in spite of having one tank almost full of gas, you will flame out and have to land because of fuel starvation.

Be very careful of fuel systems, they must be absolutely fool proof in order to work reliably and consistently.

NACA FLUSH INLET
We are getting a lot of inquiries about this and frankly we really cannot make your decision as to whether or not you should install it on your VariEze or Long-EZ. Here are the facts. This is all we can tell you. Please do not ask us to help make your decision.

1) You have to build the bottom of your fuselage per plans whether you use the NACA inlet or not, since this is required structure to tie the two bottom longerons together. The NACA inlet is an aerodynamic cosmetic add-on, and provides no structural tie between the fuselage sides. The NACA inlet is homebuilder-carved (no prefab parts are available) and spliced in to the standard cowl. You will not need the "CI" cowl inlet part.

2) The NACA inlet works well for cooling and is lower drag than the ram scoop, adding about 3 knots more airspeed. Since the fuselage sides are lower in the area of the main gear you get a better aerodynamic juncture between the main gear and the fuselage.

3) The sex change operation (going from the "male" ram scoop to the "female" NACA inlet) will add about 4 to 6 lb weight.

4) You may elect to install the flush inlet for aesthetic reasons only. We like the side profile view of the female EZ very much, and almost everyone who has seen it agrees.

5) RAF did not develop this installation, and therefore we cannot support you in building it. Tim Gehres and Steve Wood did all the work on it, they sell the plans, and they will support you if you have any builder questions. Contact Tim or Steve at:

Wood and Gehres Inc.
105 Appleblossom Ct.,
Orlando, FL 32807

Plans cost $20 and are very easy to follow.

SAFE-T-POXY WORKING TEMPERATURE.
Builder feed-back has indicated some difficulty using the Safe-T-Poxy in cold climates. Typical situations are where most EZs are built in garages that are difficult to heat in the winter. Problems are where the builder will heat up the room/garage (air only) and go directly to work but the epoxy, glass, parts, tools etc are still cold-soaked. In use, cold epoxy wets slowly and greatly extends the time to wet the cloth properly.

The Safe-T-Poxy has a higher viscosity than the previous resins, thus requiring a higher working temperature to use, especially on the larger layups. The high viscosity was selected for the Safe-T-Poxy to

eliminate the tendency of the previous material to bleed-out (inducing air in the layup during cure).

If you are building in a cold garage in the winter you can still use the new Safe-T-Poxy if you take the

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following precautions:

1) Warm the resin and hardner evenly to 85-90 degrees F prior to mixing. Don't try to hurry this. We use a light bulb under the ratio pump 3-4 hours prior to use, or keep you resin jugs in a cabinet with a light bulb inside.

2) It's important to have everything thoroughly warm prior to starting to work. This also cannot be rushed. It takes time to get the parts (wings, foam blocks, etc) up to a stable temperature throughout. If you are starting from a very cold garage the warming process could take 4 hours or more. Don't think just because the air is warm that all the material is warm.

3) Use an electric hair dryer to warm the area as you work, being careful not to over-heat the part or epoxy. When, due to cool temperatures, a part is slow to wet out, a few quick passes with a hair dryer will greatly speed the layup time. Do not use a hair dryer to heat a cup of epoxy. This can give local hot spots and ruin pot life.

What shop temperature is satisfactory? That has a lot to do with the size of the job. Small jobs can be worked to as low as 65 degrees F but the working time will be excessive. It will also be more difficult to remove excess epoxy, resulting in a heavier part. On large lay-ups like the fuselage, wings, etc., where there is a lot of epoxy to drag around, 77 degrees F should be considered the minimum. That's epoxy prewarmed to 85-90 F and all parts, glass, foam, tools, table - everything up to 77 F for 4 hours then go to work. Those temperatures are minimums - add 5 to 10 F and your working time will be greatly reduced and parts built lighter. Optimum working temperature range for the Safe-T-Poxy is 77 - 95 F.

PLEXIGLASS HINTS FOR PERFECT CANOPIES.
1. Cutting: An abrasive disc powered by a high speed drill, a Dremel tool, or a hand held circular saw is recommended. We have found that abrasive cut-off wheels of aluminum oxide or silicone carbide provide excellent cutting results. A six inch disk is available at most hardware stores for around $3.50 A small grinding disc or Dremel saw disc will also give good results. Reciprocating saws like saber saws are not recommended and will probably break your canopy. A tool that progresses slow and hot on the canopy to grind through the canopy is best. Tape a poly plastic cover on the canopy and mark your outline with masking tape. Never cut a cold canopy. Allow the canopy to warm to 70 or more for at least an hour. Don't allow the canopy to vibrate or chatter during the cutting or it may chip and crack. Support your canopy on a flat surface so it will not twist or spread during the trimming. Duct tape is handy to hold things in place. Remember: cut slowly, don't push the cutter. Let the tool do the work. Be sure to

use eye protection. Plexiglass chips can be a problem in your eyes since they are clear and difficult to see.

2. Drilling: The drill should be ground off to a zero rake angle to prevent digging in, chipping and cracking the Plexiglass. A standard drill bit, ground with no cutting edge pitch, is a safe method of making holes. Be sure to make the holes oversize to allow for motion caused by thermal expansion and contraction. The drill bit should not be allowed to chatter or will chip and break the Plexiglass. Don't push the drill. Let it cut at its own rate.

3. Cleaning: A damp soft cloth or an air blast will clean the saw dust away. The damp cloth will also dissipate static electricity. To clean dirty plexiglass use plenty of water and a non abrasive soap or detergent. Dry with a clean chamois or soft cotton. Never use acetone, benzene, carbon tetrachloride, lighter fluid, lacquer thinners, leaded gasoline, window sprays or scouring compounds. Grease or oil may be removed with kerosene, white gasoline, naphtha or isopropyl alcohol. Small scratches can be buffed out with "Mirror Glaze" HGH-17 and a lot of rubbing. Hard automobile paste wax should be applied as a protective coating and buffed with a soft cotton flannel cloth. Do not use cheesecloth, muslin or shop cloths, they scratch. For deep scratch removal, procure a hand polishing kit from a Plexiglass dealer or your canopy supplier.

NEW EZ FIRST FLIGHTS.
We have not reported VariEze first flight names since CP 23. The following list is those who, based on our information, have made an EZ first flight since 12-79. If you know of someone who should be on this list please send us the name, address, N-number and date of first flight.

Vic Mondary	N500EZ	IN
Richard Clark	N89EZ	CA
Alex Dimuro	N22803	HI
Tharon Judd	N77TJ	TX
John Benjamin	N40EZ	PA
Bob Erdmann	N245EX	CA
George Saxon	N11SK	MS
Jimmie Clark	N11SQ	TX
Jack Mitchell	N55VE	AL
Roman Wasilewski	N24RW	CA
Al Coha	N2CR	CA
Buzz Weatherly	N37517	MI
Alan McPherson	N45790	CA
Jud Bock	N681JB	NE
Dennis Deavers	N?	AL
Brad Cantrell	N13NM	CA
Jack Graehl	N80JG	CA
Ray Miller	N10ZM	CA
Marshall Randall	N2CR	CA
Ron Sukel	N78AR	CA
Don Elkins	N106	LA
Norm Spitzer	N77NS	CA
Errol Lima	N?	AZ
Elvin Kime	N80EK	MO
Paul Bergholtz	N80PB	MI

Canard Pushers from 1 to 82

Gerry Mason	N27GM	MI
Ivan Harneck	N101LE	MD
Tom McGovern	N43TM	IA
Bob Gentry	N24BG	OR
Bob Yaple	N1050G	CA
Hank Ashmore	N34HA	TN
Martin Pavlovich	N810TC	WI
Rex Sylvester	N24EZ	UT
Lewis Porter	N32LP	TX
Joe Moore	N80681	CA
Robert Ridihalgh	N25RR	IA
Vernon Lovelace	N37LL	IL
Chuck Ray	N45CR	CA
Wes Gardner	N13WM	CA
Fred Wimberly	N99FW	VA
Jim Giesen	N857EZ	MN
Lynn Coltharp	N40CL	OK
Roger Lonsway	N15RL	FL
David Turansky	N16DT	NY
Robert Harris	N8021B	IN
Gary Hornbeck	N76PG	MO
Lee Carlstrom	N56LC	LA
Patrick Wehling	N80PW	MD
Andre Briquet	FPYHR	FRANCE
Norman Dovey	N16ND	FL
Seig Halhfpap	N8477T	IL
Don Prestin	N39DP	CA
Bill Nipkau	N78BN	CA
James Frizzle	CGLJZ	CANADA
David Hesterlee	N86DH	GA
D. Sablayrolles	FPYHU	FRANCE
Michael Myal	N797MM	MI
Chuck Weitzel	N88EZ	MI
Elvin Kier	N5ZY	IL
Wayne Johnson	N725EZ	CA
Marc Brewer	N47EZ	IN
Earl Wilson	N999EB	CA
Robert Boyd	N98RB	ID
Roger Pearman	VHEZO	AUSTRALIA
Harry Benson	N78VE	ID
Ray Lancaster	N44GG	TX
Merle Musson	N76LM	MO
R. Crandall	N35PC	MS
Earle Thompson	N55EF	AL
Les Smith	N1055K	CO
N. Rossignol	N23NR	CT
Lyle Flogerzi	N18MF	CA
Richard Freeman	N151VE	CA
Earl Haquewood	N24EH	CA
Donald Shaw	N42DS	CA
Harlan Boyer	N95EZ	PA
Jack Sargent	N75EZ	FL
Joe Walker	N419JW	FL
Larry Smith	N555LS	CO
Raymond Bazin	FPYHS	FRANCE
Mike Guthrie	N249MG	CO
Steve Briggs	N15EZ	MA

Curt Poulton	N79CP	OH
Gene Horton	N1171E	TX
Robert Schubiger	HBYBL	SWITZERLAND
Richard Harkness	N80VE	SC

PREFAB FUSELAGE SHELLS FOR LONG-EZ

When the second VariEze prototype (N4EZ) was built, we considered prefab fuselage skins. These would be 2-piece shells fabricated by vacuum-bagging a glass-foam-glass sandwich into a female mold. An analysis of cost and construction savings showed that the time saved was minor, particularly considering the extra work involved fitting the bulkheads and systems to the rounded interior.

Fuselage shells bagged into molds should have a potential of a weight savings and a savings in exterior finishing work. However, based on our components and the results of the prototypes which have been built both moldless and molded, the weights of completed ones. The molded-shell method is a good one for the bulky fuselages of side-by-side airplanes, where extensive compound curves are required. However, they are not cost/time effective for the Long-EZ Their production cost is high due to mainly tooling amortization, reject rate and packing requirements.

To say that pre-molded fuselage shell would significantly reduce building time is not true. Effect on total building time is less than 3%.

Long-EZ Fuselage Shells

Time Savings - Man Hours

Chapter 4	-5 mh	Round bulkheads
Chapter 5	+15 mh	Fab and glass sides
Chapter 6	-8 mh	Exterior jig required
Chapter 6	+10 mh	Carve and glass bottom
Chapter 7	+13 mh	Carve and glass outside.
Total	25 mh saved - 2.5 percent	

Fuselage shell cost, including packing and shipping $500 - more than materials for moldless construction. Results = $20/man hour.

SHOPPING

Aircraft Spruce has come up with a really nice placard sheet. It is black vinyl with white printing on it, and a sticky back. It has just about everything you will ever need to label your instrument panel. They have printed each item four times so if you ruin any you have some spares. You can cut them out of the sheet with scissors, peel off the back and stick the label in the appropriate position on your panel. There is even a complete checklist and a passenger warning sticker.

Lycoming O-235 1600 SMOH, 800 STOH in storage new crankshaft and cam at major overhaul.

Call: Bill Clark

(301)889-5092
(301)256-5671 (after 6pm EDT)

Lycoming O-235-C1 0SMOH, new crank, new cam, new bearings, chrome cylinders, fuel pump. Zero time, slick mags. Modified for 100 Oct. $4000 plus shipping.
Call: Charlie Gray,
(305)822-5040

Continental C-85-8. Fresh overhaul, 6 hours run in time. New Slick mags and harness.
Contact: Joe Moore,
11320 Hubbard Rd,
Grass Valley, CA 95945
(916)265-4952

Lycoming O-235-L2C factory remanufactured engines specifically set up for a Long-EZ. They include fuel pump, MA3PA carb with accelerator pump, oil screen and slick mags. Also has new Lycoming engines to your specification.
Contact: Norm Bender
804 Meadow Lane
P.O. Box 30343
Memphis, TN 38130
(901) 365-6611

Six Continental O-200-A engines for sale.
Contact: Rudolph Spremich,
520 Turquoise Street,
New Orleans, LA 70124

Dick Waters of Florida can supply Lycoming engines to suit your requirements, and is also working on an accessory case to accommodate a mechanical fuel pump. This will be very useful for builders who have engines without fuel pumps.
Contact: Dick Waters
1325 W. Washington St., Bldg B-8
Orlando, FL 32805
(305) 422-0188

An Original VariEze main gear strut for sale. $195 and also several other VariEze parts.
Contact: Wm. C. Morgan,
6295 White Mill Rd. Rt #3,
Fairburn, GA 30213

Shopping at RAF.
The following items are available from RAF. Tie Tacs and Charms - Silver and Gold - $6.50. These come both VariEze and Long-EZ.

Belt Buckles, VariEze and Long-EZ, VariViggen. These come large for guys and little for gals. Shiny or brushed finish. $20.00 each.

Three ship poster of the Defiant, VariEze & VariViggen. $2.75 each or $5.00 for two plus $1.00 postage.

We try to keep in stock a selection of the Canopies which are for pick up at RAF only. If you give us approximately 2 weeks we usually can get the color you need.

Clear canopy	$199
Green canopy	$229
Smoke or Bronze	$249

Main Gear $309 and Nose Struts $55.55.
We still have a lead time of 7 to 8 weeks. Because of trying to get the gear shipped as soon as possible, please send your payment with your order. We will hold your check until your gear is shipped. If you are going to pick the gear up here at RAF please do so within 2 weeks as we have a storage problem and if you do not need your gear we will joggle your name back down the line. We have so many people needing their gear that we do not feel that we can hold the gear for an indefinite period of time.

Video tape - Building the Rutan Composite.
This tape runs for 96 minutes and covers every phase of construction. The tape comes in either VHS or BETA $49.95 plus $4 for postage.

Resin/Hardner Storage.
Several builders have reported that their resin or hardner or both have settled out or crystallized. Do not use your resin or hardner while is is in this condition. This problem is caused by temperature cycling. Never keep your resin or hardner in a cold place or on a cold cement floor. It should be stored up on a shelf at room temperature. If you see your resin or hardner start to crystallize and settle out, is it important that it be returned to it's normal clear state as soon as possible, even if you don't plan on using it right away.

To return crystallized or separated resin or hardner to it's normal state, place the jugs (caps on tight!) in hot water (160 F to 190 F) until the crystallized material goes back into solution. Be patient, and occasionally agitate the jugs. The longer you leave the jugs in hot water, the less likely this is to occur again. Depending on how badly the material gas crystalized the process could take 30 minutes to 3 hours.

If after 5 hours at 160 F - 190 F your resin or hardner has not become clear, return it to your distributor. Once it is clear and provided you store it at room temperature, it should remain clear, and the structural qualities of the epoxy will not be impaired.

Questions: I have built part of my aircraft using Safe-T-Poxy without checking my ratio pump. I now find that the pump is for the older epoxy with 20:100 ratio. What now?

Answer: You must discard all parts built with the wrong ratio. Epoxies should be mixed as accurately as possible. Errors as much as 10% can be accepted but definitely no higher. Structural integrity, particularly long-term will be unsatisfactory with the enormous error in ratio you have been using. Note that it is a good idea to occasionally check the delivered ratio of your pump. Check that the

valves are clean. You can modify the ratio of these pumps by drilling a new pivot hole for the handle. If the pivot is moved to the left the ratio of hardner to resin is increased. The 20:100 pump will deliver 43:100 if the pivot is remote, about 30 inches to the left of the pump. If you use a remote pivot be sure to clamp the pump base securely to the workbench and provide a stop to prevent piston over travel. (see CP #).

STICKING FUEL VALVE
Some VariEze fliers continue to have problems with their fuel valves sticking. In CP 17 we reported that tight valves must be overhauled before flight. The brass valves can be fixed by dismantling, cleaning and installing a lighter spring (or cutting some off the existing spring). If this is not completely successful the valve must be replaced. In CP 18 we switched to a Weatherhead #6749 valve with a Delrin spool. This appeared to solve the problem. However, a few people still had valves that were hard to turn. Recently a VariEze had a forced landing due to fuel starvation. The airplane was damaged, but fortunately the pilot was not hurt. Examination of the valve revealed that the Delrin spool had broken internally and the valve handle would not turn the spool. This valve had become so tight, on one occasion it required pliers to turn. This VariEze should have been grounded for valve overhaul.

CAUTION If your VariEze fuel valve (brass or Delrin) takes more that 5 lbs. of force to turn it, (10 lbs. is ok for long-EZs) ground your airplane until this is fixed.

The best fix is to shorten the spring by cutting some off and lubricate the valve spool and body with Parker fuel lube. (as reported in CP 25, page 5). Do not treat this situation lightly, you could destroy your aircraft for lack of fuel and yet have plenty of fuel on board.

CAUTION

There is some bad information circulating around about painting styrofoam with Latex house paint before glassing. This is totally false, and should not be done under any circumstances. The foam is there not only to give the correct shape to a part, but to provide buckling support to the stressed skin structure. In order for this support to be adequate, the glass skins must be bonded very strongly to the foam core. If you have a coat of house paint between the glass skin and foam core, this bond cannot be any stronger than the coat of paint. This is a serious structural problem and could very easily lead to a structural failure. If you have built any parts using this method, consider these parts unairworthy, and discard them.

Rebuild them using the correct method, as described in the plans.

CAUTION!
We are getting an alarming number of calls from builders asking questions that have been clearly answered in a previous newsletter. The information contained in the CP is more important than the plans, since it is more current.

When you receive your CP, read it very carefully, and read all of it, not just the plans changes. Jot down comments, builder hints, etc. on

the appropriate plans pages, and of course all plans changes must be written into your plans.

Remember, the only way we at RAF can get updated information, plans changes, or mandatory safety changes, to each builder, is through the Canard Pusher newsletter.

NEW TIRE TESTED
We recently tested a neat 6 ply tire for both VariEze and Long-EZ which is a little larger than the 3.40 x 5 Goodyear tire, but looks just exactly like a miniature 500 x 5 aircraft tire. It has a smooth rib pattern and is rated to 70 lb./in. We have a pair on N79RA, together with a pair of the current small wheel pants, and we like the tire, and recommend it for all VariEzes and for those builders of Long-EZs who do not want to use the larger 500 x 5 tires.

This new tire should be available through Aircraft Spruce and Wicks Aircraft. It is an 11" x 400 x 5 6 ply ribbed tire. Be certain to use only the 6 ply rated tire.

Mismatch on the Main Gear
Due to a mold shift, a few Long-EZ main gear struts have been shipped with a slight mismatch. We inspect every strut and have determined that a mismatch of up to 0.1" is of absolutely no concern structurally. You can sand the surrounding glass down to match, or you can build up the low spot with strips of UND and Safe-T-Poxy. Either method is acceptable. A disc grinder with a 16-grit heavy duty disc is best to remove the flash. Be sure to wear a dust respirator and protect your skin with Ply-9 to prevent itching. **SKETCH OMITTED**

ADDED CRUISE EFFICIENCY CHART
The Long-EZ Owners Manual cruise fuel flow chart plots fuel flow vs. indicated speed (in knots) with lines of altitude. The chart below may be more handy in flight planning and can be added to your Owners Manual. **CHARTS OMITTED**

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category Definition

MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LONG-EZ PLANS CHANGES

LPC #65, MAN GRD
There are indications that the back injury noted on accidents (pg 3) may have been caused by the center speed brake diagonal being forced through the seat back after failure of the landing gear and the airplane's belly impacted the ground. Refer to the sketch and remove the portion of the plywood bulkhead (part #LB9) shown to allow it to collapse without piercing the seat bulkhead. Double check that the speed brake arm (#LB20 & #LB2) does not go over center with speed brake down - recheck the 40 lb. closure force. **SKETCH OMITTED**

LPC #66, MEO
CP #28, Page 9, LPC #61, the part #6083 should be #60883.

LPC #67, MEO
Section I Page5-3, nuts on the AN6-80A bolt should be AN363-624, not MS21042-6.

LPC #68,MEO
Section I Page 4-1, note at the foot of the page. Remove "NOT" so that it reads, "micro slurry is used on this type R45 foam. We do recommend slurry to be used on all of the various foams in a Long-EZ.

LPC #69, MEO
Section IIL, Page 14, Conical engine mount. The 7/8" O.D. x .049 cross brace tube must be moved down in order to clear the fuel pump. It is shown in the correct position on page 15.

LPC #70, MEO
CP #28, Page 8, under builder hints, UND layups on the fuselage sides should be + 30 not + 45. This is shown correctly in the plans.

LPC #71,MEO
Section I, Page 2-1, add to Ken Brock parts list - 4 spacers A4-84 and 2 nuts J1.25 (axle spacers and nuts).

LPC #72, MEO
Section VI, Landing Brake Page 2, part number LB10 should be changed to make the "ear" 1/2" longer to avoid interference with LB3. If you

bought this LB10 part from Ken Brock, this change has already been accomplished. **SKETCH OMITTED**

LPC #73, DES
Owners Manual checklist page 66. After "canopy-locked" add "visually confirm proper canopy latch engagement and proper safety catch engagement".

LPC #74, DES
Owners Manual Page 47, add, CAUTION prop bolts - recheck torque (180 in.-lbs.) before next flight when a transition is made from a wet climate (high humidity) to dry conditions. Wood shrinkage in dry environment can loosen prop bolts and result in flight loss of the entire propeller.

VARIEZE PLANS CHANGES.

See LPC #65
This applies to VariEze as well.

Owners Manual, Page 38.
Add CAUTION prop bolts - recheck torque (180 in-lb) before next flight when a transition is made from wet climate (high humidity) to dry conditions. Wood shrinkage in dry environment can loosen prop bolts and result in inflight loss of the entire propeller.

COMM ANTENNAS - VARIEZE.

The Comm antennas that mount on the landing gear can break after some time in service. This is because most builders apply the copper foil to the underside of the strut. The strut flexes and bends under taxi and landing loads and will eventually fatigue the copper foil. This can be prevented by attaching the copper foil to the leading edge of the strut.

Larry Lombard installed an excellent loop-type comm antenna in his VariEze. It is made from 1/4 inch wide copper tape. It is a full loop antenna, and has no ground plane. This copper foil should be installed per the sketch below, and ideally you should start

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out with it about 102 inches long, and, using a SWR meter, optimize it by trimming it off in small increments. Larry's is approximately 99" long, but this may vary slightly from airplane to airplane and radio type. It is important to orient the copper foil as vertical as possible on each side, then let it form a "V" under the top cover and a "W" on the floor such that it clears the nose wheel well. A short piece of RG58-AU should extend from your radio to the fuselage side at approximately the mid point vertically. Solder one end of the copper foil to the center conductor of the RG58AU and the other end of the copper foil will solder to the shield of the RG58AU (after checking the length). Put one ply of light weight fiberglass or BID over the foil to protect it from damage, and you will have an excellent drag-free comm antenna.

SKETCH OMITTED

LONG-EZ BUILDER HINTS
Several builders have enquired about using the Rolls Royce 0-240. We have never tested this but it should be an excellent engine for the Long-EZ. It is certificated for use as a pusher, it comes standard equipped with a mechanical fuel pump and weighs 246 lbs. complete with starter and alternator. The only drawback that is immediately obvious is that the induction system comes up over the top of the cylinders which will necessitate a blister on top of the cowl on each side. We should see one or two installed in Long-EZs within the next year or so, and we will publish any data we get in future CPs.

A cheap automotive battery cable terminal cleaner (approximately 85 cents) makes an excellent foam carving tool, and works great in small corners.

Small sanding discs made by Merit Abrasive Products, Inc, P.O. Box 5448, Compton, CA 90224, work very well on a dremel tool. This company sells holders and sanding discs and calls them 1 1/2" diameter power lock holder and disc.

When you Bondo your wing jigs to the floor, be sure to Bondo them so that you can remove the bolts and spit the jigs vertically or you will not be able to get the foam cores into the jigs.

If you elect to use Rochester electric gauges, be sure to run a separate ground wire from all the electric gauges to the firewall. This will assure accurate, non-fluctuating indications. Simply hook all the electric gauges ground terminals together and run one 22 ga. wire from the instruments to the firewall or engine.

On the centersection spar caps and wing spar caps, most people will require the extra plies as called out in CP #25 and CP #28. If you are going to need the extra plies, it is best to apply them in order. That is, the longest ply should go on first, and the shortest ply should go on last.

CLARIFICATION
Section I, Page 4-2. Several builders have had difficulty understanding the sketch of the aft seat bulkhead. This sketch shows a 0.95 taper in the left side. Since this is a symmetrical part, it follows that there is also a 0.95 taper in the right side. This fact is verified by the dimensions shown. **SKETCH OMITTED**

Vince Golden (Long-EZ builder) sent us a really neat homebuilt hot wire alternative to the Variac. Vince built one and sent it to us and we have been using it for a couple of months and find it to be excellent.

Part required:

1 Hardware store dimmer switch	$4.59
(We used an 'ener-g-save' push on/off single pole)	
1 Capacitor .22UF 200 VDC	.35c
1 Resistor 220 OHM 1/2W	.20c
1 Transformer 28 VAc 4 Amp Tranex 24-10024	$7.50
	$12.64

You will have to modify the dimmer switch, by installing the capacitor and the resistor inside the dimmer switch box. This will also give you the ability to run a single speed dremel tool as a variable speed.

Wiring Diagram **SKETCH OMITTED**

Dimmer Modification **SKETCH OMITTED**

Note! By disconnecting the transformer the dimmer can be used to run a dremel or electric drill.

BID TAPES
There is still some confusion as to what BID tape is and where and how it is used. BID tape in not a purchased item. You can not buy a roll of BID tape. You cut it from your 38" wide roll of BID glass. BID tape should be cut in 2" or 2 1/2" wide strips at 45 degrees to the selvage edge. In most places where you will use BID tapes (eg. fuselage sides to bulkheads) you need to lap 1" onto the bulkhead and 1" onto the fuselage side. Therefore you need a 2" wide tape. In actual practice it is wiser to cut the tape 2 1/2" wide, because it will stretch and get narrower between the cutting table and the airplane.

If you need a longer BID tape than you can cut off a 38" wide roll, it is ok to join the tape by lapping 1/2".

Since you cannot squeegee the BID tapes very easily you should wet them out with a brush, then peel ply the edges to give a neat smooth finish and also to help dry out the layup. Add a minimum of epoxy to wet out the peel ply, rather use the peel ply to soak excess epoxy out of the BID tape layup. Always peel-ply all edges of tapes.

VARIVIGGEN NEWS

Leonard Dobson of Georgetown, Texas, has his Viggen finished and it is absolutely gorgeous! See photo. "Dobby" reports that he started construction July 1978 and has invested approximately $16,000 and 5000 man hours! While in the final sanding stages he felt like he was cleaning an elephant with a tooth brush! Anyway Dobby, congratulations on completing your Viggen, sure hope you can get it to Oshkosh.

Ken Winter of Tulsa, Oklahoma, reports that he should be at Oshkosh with his Viggen, which at last report was complete except for final engine control hookup.

Arthur Schwartz has over 65 hours on his Viggen now and reports that he will be at Oshkosh. Arthur is having lots of fun visiting different airports.

Gene de Ruelle has started working again on his Viggen project after a period of inactivity, and he reports finding a Cessna 150 flap motor and jackscrew, which has worked out real well for his reflex. The unit came complete with wiring and limit switches and a pivot mount that is

a perfect fit. Gene got his from San-Val parts in Van Nuys, CA. and paid $54 for it. See photo. Gene is building his verticals now, and reports that Jesse Wright's kit is really a big help.

My Viggen N27MS is still running like a dream, the only problem encountered has been a bad magneto coil in one Bendix mag. I am presently overhauling the mag and just generally giving the "old girl" a good inspection in readiness for the annual cross country to Oshkosh. N27MS first flew in September 1977, that makes her almost 4 years old with just over 500 hours.

Hopefully this will be the first year that we have had more than one Viggen at Oshkosh, and we have a possibility of as many as three. Sure would look great to see a flight of 3 Viggens in the pattern!

For Sale: VariViggen project. 1st Edition plans with all updates, Spruce kit, fiberglass parts, wing attach fittings, Cleveland 500 x 5 wheels and brakes, master cylinders and brake pedals. Will trade for Long-EZ plans and parts.
Contact: Ron Lorimor
1909 Rock Street #6
Mt View, CA 94040

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Gene de Ruelle's VariViggen, on the gear.

Reflex motor drive mechanism in Gene's Viggen.

Trisha Palmer joined RAF in December '80. Trisha is the one you guys now talk to on the phone. We are hoping to make a pilot out of her soon!

VariEze canard in a specially designed load testing device at the University of Texas, in Arlington. Prof. Jack Fairchild conducted the test to destruction on two canards.

Hans J. Zuckschwerdt's EZ undergoing a static load test to meet German DOT requirements.

Han's EZ after completion, and now flying.

Leonard "Dobby" Dobson's beautiful VariViggen, ready for first flight.

LONG-EZ

FAST - EFFICIENT - HIGH UTILITY - LONG RANGE

Long-EZ N79RA with 75 gal. back seat tank during the world distance record flight. **PHOTO OMITTED

THE AIRPLANE
The Long-EZ is a small, high-performance, high-utility homebuilt sportplane. While recommended mainly for Day-VFR operation, competent

pilots can also equip it for night and IFR flying. Power plant is either the 0-235 Lycoming or the 0-200 Continental. It has an alternator-powered electrical system and can be equipped with electric engine starter. It's cockpit layout is designed to compliment pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wing strakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 P.V. core foam. (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal or wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

TRAVELLING MACHINE

At last, an airplane that is specifically developed for efficient, high speed, long-range travelling with room for two adults and plenty of baggage. Fuel allowance with two adults is 38 gallons. Single-place, you can carry 52 gallons! If you're in a hurry, you can cruise at 75% power at 8000 ft at 185 mph (161kts), burning 6.51 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles), in 5.2 hours with a 40 minute fuel reserve. If you're not in a hurry, you can cruise "economy" at 12000 feet at 144 mph (125 kts), burning only 3.52 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 10 hours with a 40-minute fuel reserve. Single place, using the entire 52-gallon fuel capacity, stretches the maximum range and endurance to over 2000 miles and 16 hours!

The high efficiency, long-range capability increases a pilots options for fuel availability and weather detours. The fact that the Long-EZ can carry the same load and fly as fast as other 160-180 horsepower aircraft, means large fuel savings - 29 mpg at fast cruise, 41 mpg at economy cruise.

UNUSUAL EFFICIENCY

The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a worlds distance record, and landing with enough fuel to surpass 5000 miles. At that, it's capability was not taxed - it's initial climb rate was over 600 ft/mn! At light weight, it climbed to 27000 ft in still air - an altitude unheard of for a fixed-pitch, non-turbocharged airplane. Our Long-EZ is so efficient, the engine can be

shut down while at 5-ft altitude over the numbers at only 120 knots, then it can pull up, fly at 360 degrees pattern and land on the same runway - completely without power! It's power-off glide angle is only 3.7 degrees - thus a belly-mounted drag devise (landing brake) is used for landings.

SUPERB FLYING QUALITIES
Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and safe stall characteristics. It can be maneuvered sharply, even to full aft stick, without fear of stall or spin. Flight tests show the prototype to be free from stall departures and spins for all types of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed.

Trim changes due to power, gear retraction or landing brake are all very small. It's wide cg range allows a large range of pilots or passengers weighing up to 240 lbs.

The Long-EZ's approach and landing speeds are 75 mph (65 kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.

THE HOMEBUILDER SUPPORT
The Homebuilder support. The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher", published since mid 1974, updates plans, provides building hints, etc. Complete owners manual provides all necessary information for safe initial testing and for normal and emergency operations.

THE TEST PROGRAM
The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR part 23 requirements, static load tests and landing gear drop tests exceeding part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing, and many others.

COST AND BUILDING TIME
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, control system materials, VFR instruments, plumbing, tools, tires, wheels, brakes and upholstery (cushions and special suitcases) costs about $2,900. Any of these items can be purchased separately. We strongly recommend that you get the distributor's catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

The S-glass roving molded structural fiberglass main gear and nose gear are available from RAF, at $277.95 and $49.75 respectively. Many other prefab parts ranging from propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased

from the listed manufactures. All those prefab parts cost approximately $1,600 - and using them, the competent builder can build a Long-EZ in as little as 800 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above cost of the prefab items. Contact the manufactures for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

Engine costs vary widely. Our prototype has an 0-235 Lycoming that had 1400 hours, when purchased for $1500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from $3000 to $6000. Engine accessories, such as instruments, prop extensions etc cost about $300 to $500. In summary then, total cost can run from $5300 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $9900 for everything available purchased and a zero-time engine. IFR avionics can add from $2000 to $15,000 to those numbers, with many options available.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.
Empty Basic	710 lb.
Empty Equipped	750 lb.
Solo Weight	960 lb
Gross Weight	1325 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	550/830 ft
Climb (solo/gross)	1750/1350 fpm
Cruise 75% 8000 ft	183 mph
Cruise 40% 12000 ft	144 mph
Max range * 75% (solo/2 place)	1370/965 mi
Max range * 40% (solo/2 place)	2010/1430 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200
SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order. Newsletter not taxable.		
TOTAL		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $3

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $3

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport

Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Sally Melvill taxiing out for first Long-EZ solo flight.

Long-EZ parked nose-down with two VariEzes.

The nose gear retracts for parking and in flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 30. If you are building a VariViggen from 2nd Edition plans you must have newsletter 18 through 30. If you are building a VariEze from the 1st Edition plans you must have newsletters 10 through 30. If you are building a VariEze from 2nd Edition plans you must have newsletter 16 through 30. If you are building a Long-EZ from 1st Edition plans you must have newsletter 24 through 30.

A Current subscription for future issues is mandatory for builders, as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave CA., approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to fly-ins. When arriving at Mojave by car turn east at the Carls Jr restaurant to find the airport.

When writing to RAF always send a stamped, self-addressed envelope along if you have questions. If you are making an order, its best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed your reply.

Annual Workshop/Seminar at RAF
The workshop.seminar this year will be on Saturday 28th November 1981. It will consist of a seminar by Burt Rutan and Mike Melvill from 9:00 am to 10:00 am. Flight demos from 10:00 am to 11:00 am. We will show our construction video tape at 1:00 to 2:30 pm and have question and answer from 2:30 to 4:30 pm.

Please bring folding chairs if you can. Lunch will not be served at RAF, but we will try to transport you to the "fast food".

RAF Activity
Since the last newsletter has involved; the Oshkosh convention trip, builder support, development of our RAF Model 77 sailplane, engineering

flight tests of our RAF Model 73 jet, flight tests of the RAF Model 68 Amsoil racing biplane, design of the RAF Model 78 and 79 commuter airliner for NASA wind tunnel testing, flying for several TV programs, laminar-flow flight measurements, flight demos, construction demos, and preparing a video tape to illustrate the flight test preparation of a new Long-EZ.

RAF Aircraft on the tube
Some very spectacular footage of Long-EZs, VariViggen and Defiant has been shot this summer and fall for several scheduled TV programs to be aired this fall probably during November.

1. OMNI Science Series - network depends on area, generally at 7:30 P.M. Saturdays - 10 minute segment of spectacular formations, aerobatics and remote mounted cameras.

2. Whats up America - scheduled on Cable TV - segment on Homebuilts - much of it Long-EZs at RAF.

3. Guinness Book of Records - segment of Dick and Jeana's Long-EZ shot flying up the face of Angel Falls in Venezuela, South America.

Long-EZs are flown extensively
While the average homebuilt airplane is flown less than five hours per month, the high-utility Long-EZs are proving to be quite an exception. Based on reports from the Long-EZs now flying they are logging an average of 30 hours a month. The first five Long-EZs to fly logged a total of over 900 hours flying in their first six months of operation!

Video Tapes available from RAF
We are pleased to announce the addition of a new video tape. This tape was premiered at Oshkosh '81 and was made by Ferde Grofe. It is called "Go-a-Long-EZ" and we sell it here at RAF (VHS or BETA) for $49.95 plus $4.00 handling and postage. Go-a-Long-EZ is an audio-visual presentation of the subjects covered in Appendix I and Appendix II of the VariEze and Long-EZ Owners Manual: Preparation for initial testing, including weight and balance and initial flight testing. We also have the building seminar tape called, "Building the Rutan Composite". This tape sells for $59.95 plus $4.00 for handling and postage. Both of these tapes were shown daily at Oshkosh and proved to be very popular.

EZ Clubs
Charlie Gray of Miami Lakes, Florida, has formed a group of VariEze/Long-EZ builders in the South Florida area. This is a very active group and have had several meetings already. Next meeting is at Charlie's house on Saturday, October the 24th. This is a "minimeet" and the next major meeting is December the 5th, time and place to be announced. There were 52 people present at the last get together, so you can get some idea of the size of the operation. Charlie has been out to RAF several times in the past six months and is doing a tremendous job, not only organizing this South Florida group, but helping builders with construction problems. He is building 2 Long-EZs and is quite far along with both of them. Charlie has put out a newsletter, Eze Builders of Florida, that contains some useful builder hints and also covers the meetings. Write to Charlie Gray, 6893 Seagrape Terrace, Miami Lakes, FL 33014.

Art and Bonnie Lazzarini, P.O. Box 1691, Hailey, ID 83333, phone (208)788-3453, requested us to publish their names and address in the CP in hopes that other EZ builders in Idaho might make contact, perhaps share a beer and some moral support.

RAF Conducting Instrumented Flight Test Program
For A Major Aerospace Firm
The new aircraft is a scaled flight demonstrator for Fairchild Republic's proposal for the Air Force's Next Generation Trainer (NGT) program. The full scale NGT, designed by Fairchild Republic is a two-place, highly fuel efficient, twin engine turbofan trainer intended to modernize the Air Force T-37 fleet.

In early 1981 Fairchild Republic contracted Ames Industrial Corporation to design, build and test the scaled flight demonstrator. Fairchild supplied accurate loft of the external shape of their NGT design. Ames hired Rutan Aircraft Factory to design the structure and systems and to conduct the flight test program. The scaled demonstrator is 62% of the size of the full scale aircraft.

Ames previously built the Rutan-designed AD-1 skew wing jet aircraft for NASA in 1978. The prototype scaled NGT construction effort, took seven months. The aircraft was shipped to Rutan Aircraft's facility in early September. After a six day flight preparation, the first four flights were flown within a 48 hour time period. The aircraft's maintenance availability and flight reliability have been flawless. All flights completed the planned objectives with no mission aborts. All instrumented stability tests (except spin and airload flights) were completed within a two week time period. The aircraft is now being fitted with an anti-spin parachute system and strain gauges to measure flight loads.

Flight tests to date have shown the Fairchild configuration to have the excellent flying qualities required for basic military flight training. Despite the small size of the demonstrator (1,500 lbs. gross weight and 21.8 ft. span), its handling qualities permitted the first four flights to be flown by four different pilots, one having no previous turbo-jet experience.

The flight demonstrator was instrumented by Flight System Inc. Data flights include telemetered stability and control parameters to verify the calculated and wind tunnel measured engineering information. The use of the manned, scaled flight demonstrator produces higher quality data than other methods, particularly for areas such as spin susceptibility and spin recovery. The scaled flight demonstrator was built within a schedule and cost framework that compares in scope to conventional wind tunnel programs. However, the added benefits of dynamic stability data and pilot qualitative information result in considerable improvement in the findings.

The structure of the scaled prototype is composite sandwich using oriented uni-directional carbon fiber or fiberglass for facings and spar caps and rigid closed cell foams for core. The fabrication method

is the moldless procedure with full core flying surfaces as developed for previous Rutan-designed aircraft such as the VariEze, Defiant, Long-EZ, Quickie, AD-1 and Amsoil biplane racer. Like the AD-1, the scaled NGT is powered by two Ames TRS-18 turbojet engines.

RAF hopes to conduct a similar scaled demonstrator test program on our Model 78 commuter airline design. See the October '81 issue of Sport Aviation for a 3-view of the Model 78.

NASA Tests Long-EZ

Researcher Bruce Holmes and Research test pilot Phil Brown of NASA's Langley Center recently visited RAF to study the Long-EZ. Of particular interest was the measurement of the extent of natural laminar flow on the flying surfaces. Also, the stall characteristics and departure susceptibility. They had previously measured extensive laminar flow on their full scale VariEze in the Langley 30 x 60 wind tunnel. This was verified by flight tests at Langley of Bob Woodalls VariEze. They found essentially textbook predicted boundary layer transition locations are being achieved with the airfoils on the EZ despite the presence of wing sweep and canard impingement. This is due to the stable contour that is achieved with our full core composite construction.

The Long-EZ main wing airfoil was designed by Richard Eppler. It has a steep initial pressure gradient intended to provide a reasonable probability of laminar flow despite minor leading edge contamination. The Eppler computer code predicts 32% chord laminar flow on the upper surface for a perfectly smooth surface. As the photos elsewhere in this newsletter show, the sublimating chemical tests on Long-EZs N26MS and N79RA verify that the wings are achieving the full 32% chord laminar flow. Small insect remains on the leading edge forward of about 4% chord will not trip the boundary layer. Bugs aft of 5% chord will destroy laminar flow, as will the small bump of a paint stripe. We now have documentation of the boundary layer characteristics on all surfaces and intersections of the Long-EZ.

Also of interest to NASA was the departure immune stall characteristic we have noted during our tests. NASA wanted to test the spin susceptibility to supplement the extensive data they have gathered on all types of general aviation aircraft. Phil put the Long-EZ through all types of extreme stall entry conditions: accelerated entries, vertical entries, etc. with all combinations of control inputs. He also alternated left and right rudder inputs at the dutch roll natural frequency, combining opposite aileron to add adverse yaw effects, at the maximum attainable angle of attack. Despite all combinations of gross misuse of flight controls, and attaining over 45 degrees sideslip, he was unable to obtain a departure from controlled flight. Phil left with the comment that he could find no way of inducing loss of control in the Long-EZ.

This is a stark contrast to the general aviation aircraft configurations he has testing at Langley, all of them being relatively susceptible to loss of control or spin entry from any aggravated stall entry. Many of them have unrecoverable spin modes that require wingtip rockets or anti-spin parachutes to effect recovery.

Oshkosh Trip

RAF took four airplanes to Oshkosh this year. Burt and Pat flew in the Defiant (N78RA), Larry Lombard and his wife Janet took the prototype Long-EZ (N79RA), Sally and son Keith flew in Long-EZ (N26MS) and Mike and his mother Isobel flew the VariViggen (N27MS).

Mike and Sally departed Mojave early Thursday morning and flew via Las Vegas to St. George, Utah, where the Viggen had to land for fuel. While Mike was getting gas, Sally and Keith remained at 9,500 ft. and circled. As the Viggen took off from St. George and climbed back to join up with Sally, the Defiant and the prototype Long-EZ arrived having left Mojave 30 minutes after Mike and Sally's takeoff. We flew as a flight of four for awhile, then Burt decided to go on ahead and check weather, so he and Larry pushed it up and slowly pulled ahead. We were always in radio contact, even as Burt and Larry were descending to land at Aspen, Colorado.

Sally and Mike arrived at Aspen some 30 minutes later and Sally proceeded to make Mike look bad by landing in half the distance and making the first turn off!! Burt decided that it was really too late to continue (it was only 11:00 A.M.!) so we tied the four planes down and went into town, where we spent a most enjoyable afternoon and evening. What a super place.

Next morning all four aircraft departed early, even so the density altitude was 10,800 ft. so Mike decided to transfer his mother into the Defiant for this leg. The Viggen got off ok, but rate of climb was down to 200/300 fpm. Both Long-EZs and Defiant got off and climbed well. We proceeded to Kremling VOR and then east over the Divide west of Boulder. We flew pretty much as a four ship until we started to run into a broken undercast. Burt and Pat went ahead in Defiant and found some holes and decided we should all land at Hastings, Nebraska for lunch. After lunch, Defiant headed out, while Larry, Sally and Mike flew in a three ship as far as Bascobel, Wisconsin, where Mike and Sally landed to fuel the Viggen. Then on to Oshkosh.

As you know by now. Oshkosh was bigger and better than ever. A number of Rutan Aircraft flew in during the week and Irene Rutan's "official" count was:

VariEzes -	58
Long-EZs -	5
VariViggen -	2
Defiant -	1

John Benjamin's "Plane Vanilla" Eze (N40EZ) from Lancaster, PA won the designer's award. Don Jones, from Knoxville, TN received the runner up award for his excellent Eze, N300J.

It was a particular treat to see Ken Winter at Oshkosh. He flew up from Tulsa, Oklahoma, in his new VariViggen N31WW. It was so new, it still had a few unpainted panels but that did not keep him from flying it virtually every day in the fly by pattern. Ken and Mike flew in formation, quite a land mark occasion, since this was the first time two VariViggens had ever been in the air together, although 1981 was the 10th consecutive year that a single Viggen had been in attendance.

Five Long-EZs were at Oshkosh this year, two of them were also at Oshkosh 1980, N79RA, the prototype, and N21VE, Johnny Murphy's Sweet

Music. This year Mike and Sally's N26MS and Dick and Jeana's blue renegade N169SH were there, and on the first day of the show, Dan McElroy flew in from Seattle, WA. This Long-EZ is a story in itself. Dan had completed the plane exactly one week before Oshkosh, flew off the hours, got it signed off, and arrived at Oshkosh on schedule. Actually he only took delivery of his prefab fuel strakes from Task Research 2 weeks before Oshkosh.

All five of the Long-EZs have pilots of the fair set. Dan McElroy report that his wife Ellie made the third flight on their Long and also flew 2 of the 3 legs to Oshkosh. Johnny Murphy had recently checked his daughter out in his Long and of course you already know about Sally, Pat and Jeana.

Fred Keller was there from Anchorage, Alaska, with his Grand Champion VariEze, and it looked just like it had been taken out of the mold! Absolutely gorgeous.

The Annual Eze Hospitality Club dinner was held on Wednesday evening, and it will be held on the same day and place (Butch's Anchor Inn) next year. We had a nice big room, even a speaker system, and it is safe to say that about 150 persons enjoyed themselves thoroughly. We are all indebted to the Real George Scott for making all the arrangements and acting as master of ceremonies. Super job, George! Harold "Mule" Ferguson provided some good entertainment with his high class singing and his guitar picking.

The above report is from Burt's Mom, Irene, who did sterling work on the flight line, tracking down each Eze pilot, welcoming he or she and passing out the new Rutan Aircraft patches. We are indebted to both Mom and Pop Rutan for the excellent job they did at Oshkosh. Here is a list of the RAF type airplane and pilots at Oshkosh 1981.

T.J. Hazelrigg	Decatur, IL	N67EZ	VE
David Turansky	Buffalo, NY	N16DT	VE
Virgil Larsen	Denver, CO	N18VL	VE
Curtis Poulton	Delaware, OH	N79CP	VE
Earl Elms	Galena, OH	N547EZ	VE
Bud Abraham	Dolton, IL	N224DC	VE
John Friling	Lombard, IL	N28JC	VE
Robert Rutledge	Springfield, IL	N28RR	VE
Joe Lawyer	Mesa, AZ	N9039J	VE
Carl Gearhart	Allentown, PA	N98CG	VE
George Holmes	Belmont, CA	N104P	VE
Nat Puffer	St. Paul, MN	N2NP	VE
John Benjamin	Lancaster, PA	N40EZ	VE
Burt Rutan	Mojave, CA	N78RA	DEFIANT
Larry Lombard	Mojave, CA	N79RA	LE
Sally Melvill	Tehachapi, CA	N26MS	LE
Dan McElroy	Renton, WA	N80DZ	LE
Johnny Murphy	Cape Canaveral, FL	N21VE	LE
Dick Rutan	Mojave, CA	N169S	LE
Ken Winter	Jenks, OK	N31WN	VV
Mike Melvill	Tehachapi CA	N27MS	VV

Ronald Kapperman	Livermore, CA	N16EL	VE
Bill Butters	Florissant, MO	N235LB	VE
Tom Nussbaum	El Paso, TX	N81TN	VE
Chuck Richey	Las Cruces, NM	N13EZ	VE
Willard Thorn	Canton, MA	N899EZ	VE
John Jackson	Jackson, MS		VE
M. Stockton	Witchita, KS	N51WC	VE
Lynn Coltharp	Tulsa, OK	N40LC	VE
Tom Richards	Seattle, WA	N18TR	VE
Gerald Edmonds	Rock Springs, WY	N81JC	VE
Ken Swain	Travis, CA	N422	VE
Ronald Atkinson	Fowler, IN	N	VE
Elvin Kier	Fulton, IL	N5ZY	VE
David Morgan	Middletown, OH	N68M	VE
Don Yoakam	Ft. Myers, FL	N77ODY	VE
Jonathan Sargent	Punta Gorda, FL	N75EZ	VE
Joe MacDonald	Allentown, PA	N13JF	VE
Jim Trombino	Waukegan, IL	N46JT	VE
John Good	Brentwood, TN	N66EZ	VE
Bill Rutan	Clearfield, UT	N1WX	VE
Phil Supan	Santa Clara, CA	N79PJ	VE
Don Youngs	Palo Alto, CA	N33ST	VE
Richard Wallrath	Bakersfield, CA	N34VE	VE
Bruce Tuttle	Roy, UT	N95BC	VE
Shirl Dickey	Murray, UT	N60SD	VE
Norman Rossignol	Newington, CT	N34NR	VE
Don Jones	Knoxville, TN	N300DJ	VE
Byron McKean	MeQueeney, TX	N57EZ	VE
Clarence Langerud	Austin, TX	N91CL	VE
Don Lee	Livermore, CA	N35EZ	VE
Harold Ferguson	Boomer, NC	N2286A	VE
Larry Hoepfinger	Cookville,TN	N7AH	VE
John Fowler	Iowa City, IO	N82JF	VE
Bob Woodall	Adelphi, MD	N301RW	VE
Stephan Sorenson	Carmichal, CA	N1185J	VE
Fred Keller	Anchorage, AK	N37840	VE
Bob Evens	Cody, WY	N46EZ	VE
Lee Carlstan	New Orleans, LA	N56LC	VE
Dick Cutler	Doylstown, PA	N46RC	VE
Jud Bock	Omaha, NE	N681JB	VE
Martin Pavlovich	Menomonee Falls	N810TC	VE
Joe Walker	St. Pete, FL	N419JW	VE

Our aircraft returned to California separately as each was planning different routes to visit relatives etc. In all, counting Oshkosh airshow demos, our Mojave RAF aircraft logged 110 hours and 20,000 miles on the Oshkosh trip without mechanical problems of any type.

Design Origins of Quickie-type Aircraft
Because of the high amount of confusion on this subject lately, Burt has written an article that lists many facts not previously published. This article appears in the October issue of EAA's Sport Aviation magazine.

Mike and Sally's Long-EZ N26MS
Sally flew our Long to Oshkosh and back, put 37 hours on it and used only 1 quart of oil. We have 260 hours total time now, with virtually

zero maintenance. We could not be more pleased with the airplane. It does everything as advertised and more. Most of our flying is to and from work, which includes a lot of take-offs and landings. When commuting we only fly 0.3 hours between landings. I estimate we have well over 500 landings at this time, and the tires look as though they are good for that many again. I am very pleased with the 500 x 5 tires, we get excellent tire wear and a super comfortable taxi ride. With a decent wheel pant the performance is still excellent.

Sally and I recently made a cross country trip to Fort Collins-Loveland for the Rocky Mountain Regional Fly In. This trip was 720 nm (828 sm). We flew from Tehachapi to Loveland direct, non stop. This took us over Las Vegas, Grand Junction and Long Peak (14,300 ft.). Time was 4.9 hours, we burned 27 gallons of 100 oct. We indicated 120 knots at 13,500 ft. (temp. 1 degree C) for a true airspeed of 150.3 knots (173 mph). Our ground speed, block to block was 147 knots (169 mph).

Our figures for the return trip were virtually identical, I flew out there and Sally flew back. Weather was perfect with virtually no wind. The route took us over some spectacular country, with the highlight being perhaps flying over the top of Long Peak, which is on the Continental Divide west of Loveland. The Long-EZ performed flawlessly, and handled this kind of flying with absolutely no problems. It was comfortable, both in the front seat and the back seat. Our relief tubes worked well, and I am very "relieved" we put them in! Noise level, with headsets, was very acceptable and I must say it was nice to listen to taped music to pass the time. Here is a break down of the trip.

Climb segment: 4,000 ft. (Tehachapi) to 13,500 ft.
Fuel Used: 2.4 Gallons
Time: 0.3 Hours
Distance: 40 nm (46 sm)

Cruise segment:
Distance =720 -40 = 680 nm (782 sm)
Time =4.9 -0.3 = 4.6 hours
Ground Speed =680 =148 knots (170 mph)

4.6

Fuel used 24.6 gal Fuel flow 5.35 gph
Economy 27.64 nm/gal (31.8 sm/gal)

The Long-EZ Owners Manual shows 4.8 gal/hr at 120 kt indicated at 14,000 ft. (148 kt. true) at a gross weight of 1100 lbs. Correcting this to 1350 lbs. results in 5.4 gal/hr and 27.4 nm/gal.

Thus, on this trip our Long-EZ did slightly better that the Owners Manual, and certainly more than satisfied Sally and I. We won best composite at the airshow, and really had a great time.

Engine Oil Analysis
Gary Hertzler, owner of VariEze N99VE, has made arrangements with Spectro-Chem, P.O. Box 29074, Phoenix, AZ 85036 to do oil analysis for Eze owners at FBO cost price. Contact Lou Brand, and identify yourself as a Eze owner/pilot, and Lou will send you sample kits for $7.95 each in lots of 12 or more. The kits include a sample bottle and mailer.

You send a sample of your oil, attention Lou Brand, and in return you will receive an analysis sheet showing metal present in parts per million. Spectro-Chem has built up quite a history on aircraft engines, and can comment on your results with some authority.

This is an excellent preventive maintenance procedure and we thank Gary for setting this deal up so the Eze flyers can take advantage of it.

CP30, Page 3

Trimming the Aerodynamics of your EZ

Like any other aircraft, the trim and stability of a VariEze or Long-EZ depends on correct cg position and proper contour and incidences of all flying surfaces. There is an easy way to verify that your aircraft is rigged properly with the incidences correct. This involves flying at several airspeeds while monitoring the elevator position, then comparing your data with the design information. Measuring elevator position in flight is simple since the pilot can easily see an indicator attached directly on the elevator surface. If your EZ does not handle, perform and stall exactly as described in the Owners Manual it could be due to an improper incidence or contour of the wing, canard or elevator, and you should conduct the test below to see if your elevator is at the correct position. If the elevator position is not correct, your airplane may also have a large trim change when flying into rain.

Fabricate the plate and needle from .016 2024 aluminum. Paint the plate white and the needle black. Mount the plate to your outboard elevator fairing and the needle to the elevator (use 5 minute epoxy it will later peel off without damaging your paint job). Calibrate your elevator position (plus is trailing-edge-down) using your elevator position template from Chapter 11, page 6, making a mark on the white plate every 2 degrees.

Now, load your aircraft to the mid-cg position (99 for VariEze and 101 for Long-EZ). Fly in stabilized conditions, smooth air in level flight at 70, 80, 90, 100, 120, and 140 knots indicated. Plot your elevator VS speed data on the graph shown below. Your data should fall within the limits shown. RAF is interested to see the variations of this data occurring due to tolerances from one airplane to another. If you do this test, please send us your data whether or not it is within the limits shown. **SKETCHES AND GRAPHS OMITTED**

Low-profile Locknuts

The VariEze and Long-EZ extensively use the MS21042 locknuts. These are a high quality all metal aircraft approved type locknut. One builder has reported cracks in several of his MS21042-4 nuts during installation. Our tests have shown that we can torque these nuts to several times the recommended limits and even abuse them enough to round the flats without failure. We have seen no failures in service. If you have had any failure of these nuts contact RAF describing the conditions of failure, purchase date and vendor.

CAUTION: Nose gear shimmy can fail the nose gear fork.

Many of us operating EZs are lax on checking the friction of the shimmy damper during preflight. This is EZ to do since we do not see the nose

gear when parked nose down. Always check for the 2 to 4 lb. damper friction on preflight. If the damper is free, the gear can shimmy at high speed and fail the fork within 1/4 second. Further, the failed wheel can strike and destroy your prop.

Nose wheel rigged at the proper angle and having at least 2-lbs. friction damping cannot shimmy. Some airplanes have had a bent NG17 tube that binds under load. Then, the owner backs off and the friction adjustment to allow good taxi qualities. Then with little or no load (rebound) at high speed it can and will shimmy. If your gear pivot binds, making taxi turns difficult, check you NG17 for evidence of bending, or ovalizing. Some time ago we increased the wall thickness on the Long-EZ NG17 part sold by Brock to handle the heavier loads. If your NG17 is not perfectly straight, replace it with a steel tube of at least .125" wall.

One of the reasons that the shimmy damper can easily get out of adjustment is that to get the proper force, the spring is coil-bound or nearly coil-bound. Thus, if a little wear or a slight bolt back-off occurs, the damping action is lost. To solve this, Brock is now having made a supply of springs with a heavier (.083 diameter) wire. The orders filled after October will have the heavy spring. Also, as soon as they are received (mid November) Brock will be sending the heavy spring to all who have bought the nose gear assembly. We have tested the heavy spring on N26MS and have confirmed that the adjustment bolt can be backed off a full half turn before losing adequate damping friction. With the old spring a 1/8 turn would result in inadequate friction.

The shimmy failures have resulted in the rumor that the nose gear fork is not strong enough. This is not true. The failures were due to high speed shimmy, not overload. Our nosegears have been extensively tested to in excess of design ultimate loads (CP #18, page 4) and during punishing development tests of the rough field capability (CP #25, page 3). Also, the exact assembly is currently operating at higher weights (2,100 lbs.) and speeds (90 kts) in two jet aircraft, the NASA AD-1 and Model 73 NGT, without problems of any kind. Of course, the friction is checked during each preflight.

We strongly recommend that each Long-EZ and VariEze use the CP #25 spring shock in the nose system. This greatly relieves the shock loads experienced when encountering ruts, chuck holes etc.

Rudder Pedal Failure

There have been at least two cases of failure of the top tab which is welded to the rudder pedal, and to which the rudder/brake cable is connected. One case was a gas welded, homebuilt part, and this was attributed to a poor weld. Another case was a prefab Brock part, but according to the owner, the tab had been bent and then straightened cold. If this tab should fail, it will invariably fail while taxiing under braking load, when you need it most, and directional control will be lost.

As of this date (Oct 81) Brock-supplied rudder pedals have been modified per Figure 1, to strengthen the tab. If you purchased your rudder pedals prior to this date, you can obtain from Brock a pair of tab reinforcement brackets. Brock part #LE2026R-1 and LE2026R-2, and these must be riveted into place over the existing tabs per Figure 2. This will stiffen and back up the weld which failed. Of course, you can also homebuild these brackets from Figure 2. This is a mandatory change, see LPC #86. **SKETCHES OMITTED**

Six-inch Prop Extension
Last summer we learned from Rudi Kurth of Switzerland, Ed Hamlin and Bruce Tifft, that a longer prop extension spool would reduce the cockpit noise level and possibly increase performance. We collected accurate baseline data, then removed the standard 3-inch extension and installed longer ones. We have tested 4-inch, 5-inch and 6-inch extensions.

Most of our data was for the 6-inch extension. Results are as follows: As compared to 3-inch, sound level at pilot's station and rear seat was reduced two and a half to three DBA at high speed cruise and climb conditions. Oil temperature on all three airplanes tested with the long extension was increased. Cylinder temperatures on one of the airplanes increased. There was no measurable change in the performance of any of the airplanes due to extension length. We have been reluctant to recommend the long extensions because any change in the propulsion/drive system of an aircraft must be thoroughly tested for long-term durability. We now have a total of 300 hours 6-inch time on Long-EZs with no indication of problems, and since the two 8-inch extensions on the Defiant have run 600 hours it appears that no mechanical problems are indicated. Thus, if you can stand a 20 to 30 degree rise in engine temperatures you can, with a 1.5 lb. weight penalty, achieve a significant noise reduction by using a 6-inch extension. Note that we have tested this only with Lycoming engines and cannot predict the durability of a Continental application. Also note that since the Brock spinner mates to the front flange of the 3-inch extension, it is not as well supported when using the long extension. Brock is now developing an aft bulkhead for his spinner to provide firm centering support regardless of extension type.

From the Builders and Flyers
Eze builders if Florida.
Charlie Gray hosted a dinner for EZ builders on Saturday the 18 of July '81 at 7:00pm. Dinner was at "Beefsteak Charlies". We adjourned to Charlie's large home and six car garage in Miami Lakes. Betty Gray had coffee, sodas, and cookies for us. (Maybe Charlie figured out that if everyone got heavier, his two Long-EZs will be the fastest). Charlie led the group in a discussion of current Rutan developments, then discussed the formation of a club. He felt the purposes of such a club should be things like dissemination of builder's hints, where to buy tools and supplies, a flying group, and encouragement to those starting or completing their project. Mr. Gray's ideas were well received by the group and it appears we will organize during our next meeting.

The 35 of us broke up into three groups. Some people watched the RAF composite education tape in the living room. The rest of the group then either formed small bull sessions or went through Charlie's shop to look at his two projects and tools, supplies, etc.. Many good

questions came up in the shop so the flow of information was both diverse and extensive. The best part of the discussion was that there were pilots there who had finished their EZs, some close to finish, and many just starting along with a few just making up their minds. This led to more and better information coming out from diverse points of view.

The builders who were unable to attend missed a very fine evening. We started with Charlie G. giving each plans holder a folder with note pad and a large print of a delightful sunset taken by Charlie from aloft, we then ate a leisurely meal spiced with hanger flying and building. Finally we went and seriously talked about the costs, problems, and joys of EZ building. I hope those who did miss it are looking forward to the next meeting half as much as those of us who participated in the first meeting.

Robert Dunham
Florida

Jerry Gruber of Elkhart Indiana, has been building his Long-EZ since 7-5-81. As of this date Jerry is almost ready for primer and to cap it all, Jerry has never even seen a VariEze or Long-EZ in the "flesh". His own Long is the first. Jerry has built his own fuel strakes and judging by the photo he sent us, he is doing excellent work. Jerry will have light IFR instrumentation and should be flying in 4 to 6 weeks.

Susan Smale of Bakersfield, California, called today and her Long-EZ is in primer paint and she is wet sanding ready for the top coat. Susan is doing very good work and is hoping to fly in 3 to 4 weeks. Susan is one of 4 girl Long-EZ builders whom we have talked with, all of them are coming along real well.

Don Shupe's observations at the start of his third year, since he started building "Puff" back in July of 1976.
"I just looked up the original invoice from Aircraft Spruce for $2009.11 on 7/6/76, I've met a lot of fantastic people and had bunches of super experiences. I've seen the people associated with EZ's change too. In the beginning it appeared the EZ people were different than other people in aviation; different even from other homebuilders. They seemed to know what they wanted and dug in and did it. Not many were like the seven year builders I had seen so often with other homebuilts. Now I know that EZ people are different. There seem to be more aviators among us than among builders of other types of planes. We like to fly as much or more than we like to build. We like to talk, too, as much as anybody but, we like to fly more. Ed and Jo Ann Hamlin, Bernadette and "Puff" and I have flown together with "77EJ" probably more than 150 hours of our combined 1,200 hours in our EZs and it seems to me that we talk less now in the air and on the ground because we have shared something that we don't have to talk about. When we flew over the Canadian Rockies from Victoria to Calgary together we sure felt good. We met a lot of great people and we got tired. We didn't notice that we were changing even though we were probably different from other people to start with having chosen to build this unusual plane we were changing more. The people most deeply involved with the EZ have changed even more. Burt is warmer and friendlier, Dick is happier, and I don't think that success alone can

account for all of this. The plane and the people play a very important

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part in what has happened to all or us. Bernadette and I fell in love with each other and the airplane all at the same time and it has only gotten better. If we are unable to fly "Puff" for a week or two or a month or two as when we changed engines; a part of us doesn't feel right. We fly another plane but that isn't what we need. We flew "Puff" over 280 hours that first year 1978 and spent more money than we earned but it was fantastic. We were the first EZ into a lot of airports. But we now know that it wasn't the novelty of the travel itself. It was the airplane and the intimacy of the three of us. We fly around the valley now, above the smog in the late evening, put "Puff" in the hangar and still shake our heads in the awe and wonder of what we have experienced together. For ten wild weeks in the fall of 1979 we commuted between La Verne (near Los Angeles) and Reno, Nevada, sometimes up the Owens Valley (that can be a very nasty valley, we ran into snowstorms, had to stay at Mammoth one night til the storm broke) and sometimes we would fly the west side of the Sierras and then across the Sierras by Donner Pass. Those were always 3 to 3 1/2 hour flights, fast, using nearly all of our limited fuel capacity at 10 to 12 thousand feet. Even with electric socks my feet would be nearly frozen. November and December were bad, but there was never any question in our minds, there was no other way to make a trip except in "Puff". Once the weather was so bad we had to fly commercial. We were uncomfortable in the seat. The pilot handled the plane roughly and we had to sit and wait a lot. And we missed "Puff". We've owned other airplanes and they aren't the same and they don't do the same things to you. We've talked a lot to pilots of other planes. They don't seem to know much about airplanes. They fly but they don't seem to live it. They don't seem to have the zest for flying, or the need, maybe that's really it. We have to do it. The other EZ people seem to be the same.

VariEze Weights.

Bill and Lynn Butters recently completed their VariEze, N235LB, and it is a beauty. They kept very accurate track of the weights throughout the building process. Their airplane is an excellent example, weight-wise. With an O-235 Lycoming engine, and light weight alternator, the airplane weighs 634 lbs empty.

Here is a summary of weights that Bill sent in to us. We are publishing it so that it may be used as a guideline for VariEze builders, much the same as the weight information from Mike and Sally's Long-EZ, which was published in CP26 and CP27.

Item	Bare Glass	F.Filled & Sanded	Finished
Rt wing	34(no winglet)	40.9	41.5
Lt wing	34 " "	40.8	41.5
R Aileron		4.2	4.5
L Aileron		4.2	4.5
Canard	17.4		19.8

Canopy			13.2
Spar	21.2		
Cowl	22.0		25.2
Fuselage	174		
on gear			

Engine with mags (O-235)		196
Prop ext. & bolts		5.5
Prop (Hegy)		8.25
Crush Plate & bolts		2.5
Carb		3.5
Spinner		5.0
Exhaust		4.0
Baffles		4.5
Alternator		4.8
Mag Leads		8.5
Engine mount & hardware		6.5
Radios		7.8
Seat belts		10.0
Instruments		12.0
Upholstery		11.5
		624.0
	Phantom Weight	10.0
		634.0

Question: Can I use a constant speed or variable speed prop on my VariEze or Long-EZ?

Answer: We do not recommend the use of this type prop, for several reasons. (1) weight on the tail (2) complexity and (3) the prop on a pusher like an Eze, gets a fore/aft bending load on each blade, twice per revolution as the propeller passes through the wake of the wing/centersection. This input can resonate and fail a metal prop or metal hub assembly. Only the solid wood prop is known to have an adequate safety history for this application. An "experimental" variable pitch prop recently destroyed the Q2 prototype. Also, as the following letter indicates, many or most prop developers experience failures which can prove fatal:

Gentlemen,

Rudi Kurth of Busswil, Switzerland who has a VariEze, has been working on an electrically actuated variable propeller. When completed he tried it in the Eze as a ground test stand. The propeller came apart within a few moments and ripped the engine out of the mounts doing considerable damage to the aircraft.

Whether this was due to poor design of the hub or the whirl mode I am not sure, but the propeller busted and that, for whatever reason, is vindication of the facts you presented to me. Again, thank you.

Sincerely,
James B. Fleming

Builder Hints
Long-EZ
Ref: Section I Page 9-2 and 9-3
Attaching axles to the main gear strut: CAUTION! You must set the toe-in parallel to the WL, not 90 degrees to the strut as several

builders have tried to do. The main gear strut should be mounted on the fuselage. A good idea at this point, is to stretch a tight wire down the fuselage centerline, at the level of the axle centers. This assumes your fuselage is upside down, with the main gear strut sticking up. Using a rasp or a course file, trim the faces of the strut where the axles will be mounted, to roughly give you the correct toe in. Try the brake plates on, to be sure that they seat flat onto the axle flanges. You may have to file a small radius into the brake plate to get it to seat properly. Now, position the axles on the gear, the flat machined areas on the axle flanges should be oriented close to vertical, and the bottom of the flanges should be approximately 1/2 inch up from the bottom of the gear strut. The brake caliper must be oriented forward and the top (with the airplane upright) of the caliper will be level with the top longerons or W.L. With these parameters, there is only one way that you can install the axle/brake plate/caliper assembly. When you cut the main gear strut to clear the caliper, be absolutely certain that there is a minimum of 1/16" between the caliper and the strut. The caliper must not be able to touch the strut at all, or you can have an intermittent or failed brake. Now, layup 3 plies of BID both sides of each strut and mount the axles using clamps to position the axles such that you can place a 24 inch steel carpenters square on the axles as shown on page 9-3 (section I). With the square held in position on the axle, measure from the forward tip of the square to the tight wire, (1/2 of dim. A) and from the heel of the square to the tight wire (1/2 of dim. B). The difference between these dimensions, (1/2 dim. B) minus (1/2 dim. A) should be a minimum of 0.1" to a maximum of 0.2". The smaller dimension is better, this is approximately 1/4 degree of toe-in, and will give excellent tire wear. N26MS was done this way and now has over 500 landings on the original set of tires.

Lone-EZ Ref: Section I, Chapter 6
When you assemble your fuselage sides to the bulkheads, be sure to install the firewall first, then the aft seat bulkhead, the forward seat bulkhead, the instrument panel, F22 bulkhead and then F28. If it is done in this order you will have little trouble bending the sides. There may be a tendency for the foam to crack in the area of the aft seat bulkhead. To avoid this possibility, particularly when working in a cool or cold shop, apply local heat with a hair dryer, to the foam. This will greatly reduce any possibility of cracking foam.

Long-EZ Elevator Templates
Ref: Section I Page 11-1, step I.
A few builders have reported that they have cut the templates accurately, and still ended up with oversize foam cores after hotwiring the elevators. It appears that perhaps we allowed a little too much allowance for the hot wire burn-down. So when you make your elevator templates, go ahead and clamp them together, and sand down not just to the line, but you should sand virtually all of the line off. Check your templates carefully against the full size drawing on page 11-5. Remember that 2 plies of UND (the skin) will add only .018" to the size of the foam core. Be absolutely certain your foam cores are perfect before you glass the skins.

Long-EZ Pitot Tube
Ref: Section I page 13-10, step 6.
Install the pitot tube so that it runs uphill continuously from the tip of the nose to the airspeed indicator. The easiest way is to run it aft through NG31, then over against the left side, and all the way uphill to the airspeed indicator. The tube can be attached to the fuselage side with a few narrow strips of BID.

Homebuilt Fuel/Baggage Strakes
Ref: Section I page 21-7.
Builders have reported that they built the fuel strakes without installing the wings, and when they came to installing the foam block between the wing root and the diagonal rib (O.D.) the top of the strake was too high to fair in nicely with the wing. When you are ready to install the top cover on the fuel strakes, install the wing, and check with a straight edge that you will have a nice fit to the wing. If necessary, trim the O.D. rib down before installing the tank top.

Hotwire Templates
When making identical templates, (canard, elevators, etc.) clamp them together, and use your Disston abrader to sand them to exactly the same shape. This is also valid for canard jigs.

Hotwire Cutting The Canard
Ref: Section I page 10-1, step 1.
An excellent suggestion for hotwire cutting the four foam cores for the canard is to use the outboard templates (no spar trough) only, to cut all four cores. Then use the inboard templates to cut the spar troughs on the two inboard cores. Caution: If you use this method you must leave the cores in the blocks weighted onto your table during the trough cuts. Otherwise, if the cores warp, the trough depth will vary incorrectly along the span.

This method makes certain that all four cores are identical, and also lets you cut well defined spar troughs, with no lag in the corners.

Epoxy Balance
Paul Burch had improved his balance by glueing a Sears line and surface utility level (around $3.00) to the beam. This allows you to see when you are getting close with the hardener, and also makes certain that the whole balance is level. Parallax errors are also eliminated.

Worm/Wormgear Retract Mechanism
Some builders have experienced "chatter" when extending the nose gear while static on the ground. While this has never been a problem in the air, due to air loads, it is possible to minimize this by checking alignment of worm and wormgear, and also backlash between worm and wormgear. If you have fore-aft movement of the worm, use a washer to shim it snug. This will eliminate the chatter.

Wiring From The Wing To The Centersection
Cut a 2" diameter hole in the outboard bulkheads in the centersection spar, opposite the point where the wiring comes inboard through the hotwired holes in the wing cores. Mike bought some pin male and female plugs and sockets from Radio Shack and wired nav. lights and strobe lights through these plugs and sockets, breaking the wiring bundle a few inches inside the centersection spar. This enables you to reach in

through the hole in the bottom of the centersection spar, and pull the wiring bundle down and out so that it may be disconnected in order to remove a wing. The comm. antenna (s) should of course also have a BNC connector at the same location. Mike ran his Nav/Strobe light wiring bundle out through the wing, together with the comm. antenna coax and has no perceptible interference. All this wiring is now brought inboard through a hole cut in the CS6 and CS7 bulkheads (a 1" diameter hole is fine) and then inboard to just inside the fuselage sides at which point you can drill up to a 1/2" diameter hole in the forward bottom of the spar box, and run the wiring down through these holes into the area aft of the back seat bulkhead.
CAUTION! Do not drill through the lower spar cap.

Transponder Antenna
The transponder antenna can be mounted under the front seat thigh support, and this is where quite a lot of builders have located it, however, Jim Weir of Radio Systems Technology has cautioned that it may be possible that high powered microwave energy may be radiating in very close proximity to a rather sensitive part of the pilots anatomy. To put it bluntly, it may be a little like sticking your fanny into a microwave oven! In any event, no qualified person to our knowledge has tested this, so it may be prudent to laminate a sheet of aluminum foil under the thigh support. Microwave energy will not penetrate the thinnest of metallic foils.

Wicks Aircraft
Now have brushable "Spray-Latt" canopy protective material in stock. They also carry the full line of VDO instruments and still have the Whelen strobe/nav light system (single flash) for Long-EZs.

Prefab 500 x 5 wheel pants, are now available from Aircraft Spruce and Wicks Aircraft. Hardware kits to install these wheel pants are also in stock. Instructions for installation of the 500 x 5 wheel pants are essentially the same as for the 3.40 x 5 wheel pants, except that 16 K1000-3 nut plates should be installed evenly spaced on the flange, instead of 11. .062 thick 2024-T3 aluminum is substituted for .032 for the mounting bracket. See CP 28, page 10 for these instructions.

Long-EZ and VariEze "Throw Over" Stay
Many builders noticed these neat canopy stays on Burt's, Mike's and Dick's Long-EZs at Oshkosh, and requested information on how to build one. The original idea for this came from Bob Woodall who has one on his VariEze. He had his on at Oshkosh 1980. The stay is constructed from aluminum tubing (2024-T3) .035 wall x 3/8" O.D. and a few small pieces of .025 thick 2024-T3 aluminum flat stock.. The small bushings shown were obtained from a surplus supply house in Los Angeles several years ago and we are not aware of a good source for these. The pivoting stay is mounted to the top of the roll over structure, we simply drilled a 3/4" diameter hole in the back of the roll over structure, and pushed a 3/4" wood dowel into the roll over, floxed it into place and layed up a ply of BID over it, inside the roll over to retain it. The other end is mounted to an additional hard point in the canopy frame, which is exactly the same as the rest of the hard points called out for, for hinges and canopy latches. This is not difficult to do even if your airplane is complete. Drawing next page.

Canopy Stay **DRAWINGS OMITTED**

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LONG-EZ PLANS CHANGES

LPC #75 Section I, page 9-1
The axle bolt location in the sketch on the lower left is not accurate. See sketch below. Warning - Note that the 1/16" clearance between the main gear strut and the brake caliper is a mandatory requirement. The caliper must not be able to touch the strut or the wheel pant or you could have an intermittent brake or even a brake failure. **SKETCH OMITTED**

LPC #76 Section I, page 11-5
"See detail page 5.4" should read "see detail page 11-4".

LPC #77 Section I, page 19-18. Step 11.
"Refer to chapter 6 and 7" should be "refer to pages 14-8 and 14-9".

LPC #78 Section I, page. Antennas.
Nav. antenna DES should be cut into two equal lengths from a 48" piece. Change the length to 22.8" long, not 24".

LPC #79 Section I, page 2-4. Chapter 13 material list.
SC fiberglass strut cover is listed twice.

LPC #80 'A' drawings, page A-5.
2" x 2" x 1/4" aluminum ext. shown full size page 18-3, should be page 9-3.

LPC #81 Section I, page 19-14. Section E-E.
Detail A shows the rodend bolt on the CS 132L belhorn reversed. Anytime a rodend is cantilevered off one side of a belhorn, the bolt head must be on the belhorn side, see sketches below:
SKETCHES OMITTED

LPC #82 Section I, page 5-2, step 2.
One ply of BID extend entire 103" length, this ply of BID should be at 45 degree and can be in several pieces.

LPC #83 Section I, page 9-4.
The AN960-1018 washers called out should be AN960-1016 and are not called out in the bill of materials on page 2-4. Add 4 more AN960-1016 to the 2 washers called out.

LPC #84 MEO Section I, page 21-5, step 10.
We omitted to tell you to micro a urethane foam block (2 lbs.ft3 green) to the 'flat' leading edges of the strakes, see page 21-7, cure, then carve to match proper leading edge contour (ribs R23, R45 and the wing). Slurry the foam and lay up two plies of UND crossing each other at 45 degrees to the leading edge of the strakes. Lap this layup 1/2" onto the strakes top and bottom.

LPC #85 MEO 'A' drawings, page A5, to right.
"shown full size, page 18.3" should be "page 9-3".

LPC #86 MAN/10HRS Rudder pedal weldments.
Before 10 hours of flight the top tab welded to the rudder pedal (see section I, page 13-3) must be reinforced per Figure 2, page 5 this newsletter. Also change the full size drawings on page 13-3 to show the top tab per Figure 1, page 5 this CP.

LPC #87 Chapter 13, page 4.
Change wall thickness on NG17 to .188. Change wire diameter of spring to .083.

VARIEZE PLANS CHANGES

MEO, Canard Pusher #23, page 8.
VDO 240-023 sender is not correct. The correct part number is VDO-360-25.

MAN,
See LPC #75 on note concerning clearance required on caliper to strut.

ACCIDENTS/INCIDENTS

Take Off Incident
Byron McKean damaged his VariEze in an aborted takeoff. He took time off from the repair job to write the following story for us in the hopes that publishing this information may prevent someone else from having the same problems:
"The takeoff direction was to the SE with a mild left cross wind. The runway is 2,650 ft. long, very narrow, and very bumpy and rough. There is considerable grass that is six to eight inches high growing onto the edges of the runway. There had been considerable rain in the early hours of the morning and there were numerous puddles of water on the runway. My takeoff attempt was intended to miss the majority of the puddles but my right wheel hit a long puddle causing the aircraft to veer about ten degrees to the right. I was near take off speed and saw the grass on the runway ahead of me so I attempted to lift off unsuccessfully. Seeing that flight was impossible I reduced the power, the nose dropped sharply breaking off the nose wheel followed by the nose strut collapsing into the retracted position. Additional resistance of the grass on the right side caused the aircraft to veer off the runway and into the muddy plowed field where the main gear collapsed and we all came to a stop. From the spot of the main gear collapsing to the stopped position was around fifty feet. I turned the switches off then got out and assisted my passenger out. There were no injuries other than my passenger having sore knees from pressure against the back of the front seat. We both wore seat belts and a two strap shoulder harness. The ELT did activate.

Later, upon investigation, I found a small piece of broken fiberglass wedged between the right brake puck and the brake disk. I was unable to rotate the wheel. Since the right wheel pant was torn off the landing gear prior to the main gear collapsing I now wonder if this could have caused more drag on the right side far greater than what the grass caused. Without this additional drag a "save" may have been possible.

I can understand now that when I hit the water and was pulled slightly to the right the wheel entered increasingly deeper water causing more drag and more turning to the right. There is that moment of delay while the mind digests what is happening until a response is initiated. That moment is too long.

It is interesting to me what thoughts go through the mind during the short interval of an emergency.

Some of my thoughts...
Look at all those puddles of water. Better choose a good path and try to miss most of them.. Narrow runway, run the engine up full before releasing the brakes. 2,500 rpm ok, oil pressure up, let's go. Boy is this a rough runway, nose bouncing, come on airspeed let's get the nose off this rough stuff. Ah here comes some airspeed, nose slightly off, not too much. Now here comes that long puddle, left cross wind, going to hit the water a little bit with the right wheel.. Airspeed approaching lift off, my God that water is pulling me right, this isn't

supposed to happen, come on airspeed, here comes that grass, can't hit that, can't fly if I hit that, try for a lift off, nose up... up... nose is plenty high, if it does lift off can I fly out of ground effect, don't want to end up in the bay at the end of the runway, what if the wing drops and hits the ground, no good, won't fly, damn, hit the grass, noisy, lots of drag, being pulled to the right, this can't happen... chop the power, keep wings level, bang! my gosh, I broke something, this is a crash, What an experience for my passenger, first time in a homebuilt and doesn't particularly like flying... sick... sick... sick... there goes the main gear, here comes the field, turning right, keep it level, keep eyes open, keep thinking, look... I'm still ok, hang on, brace, keep looking, it's stopped, I've really messed it up. Switches off, get out now, what about a fire, get my passenger out. We are both ok but look at my pride and joy, belly in the mud, mud everywhere, look back at where I've been!

CP30, Page 9

My VariEze is equipped with a Compucruise computer that includes a fuel flow sensor. In order to use a fuel flow sensor on a VariEze you must install an electric fuel pump. I also installed a four-way fuel selector valve so that I could select a "by-pass" position in the event of a malfunction of the electric pump, flow sensor, or inline fuel filter.

I mounted the electric fuel pump and fuel flow sensor on the center section of the main landing gear behind the rear seat. I now recognize that this is a no no! When the main landing gear collapsed it tore the fuel lines loose. Had the fuel flow sensor and electric pump been attached to the fuselage or firewall no leak would have occurred. Even the gascolator that extends slightly below the firewall into the air intake scoop was undamaged".

Forced Landings
The following information was supplied by Bruce Muirhead, from Colorado:

"Dear Burt,
I guess I should report a couple forced landings we experienced.

The first was on an early frosty morning flight from Pagosa, NE, over the Rockies to Boulder. I may tell the whole story in more detail another time but suffice to say here that it was a variation of the old "gas cap" story. The right cap didn't get secured, fell off on take off (damaging the prop some), but I didn't catch on until a temporary power loss got me to thinking over the Sangre de Christos. As Mary continued to report plenty of gas in the right tank but left running low, I was guided to make a sharp right turn and head for the plains.

There we spotted the Air Force Academy chapel and turned north, still at 12,000. A minute or two later, flame-out. We did a 180 and glided 20 miles, straight into the Academy's north-south runway, unannounced, uneventful and followed by lots of red tape.

The second was on the way to Taos for the IVHC fly-in just 35 minutes from here. Just over the mountains and letting down 25 miles from Taos

it quit. Fuel starvation on descent? Nose up - no luck. No reserve - faulty valve. A straight section of highway complete with a convenient turnoff made for another uneventful landing - at the New Mexico Port of Entry! Borrowed the officer's pickup, got five of regular, prop, run up ok, and took off on our "runway" for Taos. There most of the 19 VE pilots discussed my problem and the consensus was clogged vent line. That's what it was, thought what I dug out of it was hardly enough to analyze. Even the little fuselage tank vent was plugged. Anyhow, you can bet those other 18 pilots at Taos will check their vent lines, and probably also,
Yours truly,
Bruce Muirhead.

RAF comment - we don't know why Bruce was unable to use the reserve tank to save the situation for both these cases - apparently the "faulty valve". You VariEze guys should always keep your reserve system in good operating order - its your redundancy to protect against vent clog, lost cap etc. Note: The Long-EZ while not having the reserve tank, has separate left and right pumped systems (which feed with a lost cap) and separate vents.

Engine Failure, On Top, Over Lake Michigan
A VariEze accident claimed the lives of a New York couple and their son enroute home from Oshkosh. The pilot was a low-time relatively new private pilot taking his first cross-country trip in the airplane, which had 49 hours total time. The following information is from a VariEze pilot who was flying with the Eze that crashed, and from FAA investigators.

The flight was heading east across Lake Michigan to save trip length even though it was over a solid under cast with tops at 10,000 feet. They were cruising at 11,500 feet directly over the center of the lake when the pilot noticed zero oil pressure. They continued another 10 to 15 miles when the engine lost power, then quit. The wingman noted that the pilot kept turning right during the trip and he had to keep instructing him to turn left to remain on course. He repeated this instruction as the pilot descended into the clouds in a right turn. Radio communication was lost when he tried to get him to switch to Muskegon Tower frequency for vectoring. Weather at the surface was a variable ceiling ranging from 500 scattered to 1,500 broken to 4,000 overcast.

It is not known whether the pilot became disoriented in clouds during the descent. The last call heard by the wingman was a very upset voice repeating 'engine quit, going down'. Flight service received a call of 'shoreline in sight' with no further communication. The aircraft crashed while in a turn in a down-wind direction at the far end of a 150 foot long clearing, immediately cartwheeling into trees. There was no way to survive a landing where the aircraft impacted. There was no fire. It is not known why the pilot selected the small clearing when the shoreline with alignment into the wind was apparently available to him.

Investigators determined the cause of engine failure to be oil loss through a broken oil pressure sender line. The line was aluminum tubing, flared with an incorrect automotive flaring tool. It fractured at the fitting sleeve where it had been previously bent 45 degrees.

The purpose of us printing details of this kind of tragedy in this newsletter is to alert those flying other airplanes to conditions that might cause another accident so that recurrence can be prevented. If you are flying an airplane that may have an engine installation that has not been inspected by a qualified A.I., ground it until it is adequately inspected for aircraft-approved installation materials and workmanship. All plumbing of oil and fuel lines must be of components approved for a certified installation. If you have aluminum tubing installed, replace it with approved flex hose before flight.

Canopy Emergency
Joan Richey, Los Cruces, NM experienced a canopy emergency in her VariEze. As is generally the case, she forgot to lock it due to an unusual break in routine. Her full story follows:
"Charles, and my instructor, Joe Gold, had started the Eze and said he'd like to fly it a little, too. So I took off, flew over town and up the valley some, came back, landed, taxied up to where Joe was waiting, got out, he got in (engine still running), a friend came up and asked for a ride. Joe shot a landing, came back, jumped out, ran around the plane sniffing - smelled something burning. Took up the passenger, came back, changed passengers, said the radio had burned up. Took off, flew a short time, came back and I decided to fly again. "Ok" says he "but don't even fool with the radio

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because it's not working". Didn't turn off the engine. I climbed in, said I'd shoot 3 landings and take it to the hangar. I always fly with earplugs under the head-set - didn't take time to put them in. That's #1. Engine hadn't been stopped - didn't do my standard check with run up. That's #2. Took off and did not bring up the gear since I was just going to shoot landings. On turning downwind to base, the sound in the cockpit changed but I could not identify it (no earplugs). Base to final, the canopy popped up to the full throw of the safety latch. I panicked! All the stories Charles had told me and I had read of canopies coming open, all of a sudden, seemed to have culminated in funerals. My initial thought was "I'm dead". Tried to hold the safety latch down, tried to latch the canopy. After the initial panic, I remembered some words of wisdom in a CP Charles and I had discussed. FLY THE AIRPLANE! Next thought - "Climb, gain altitude and latch the canopy". Third thought - "Land it!" By now, the panic is gone, I'm a little high and a little fast. Have not managed to trim it to landing speed. After all, a girl's only got two hands and both are holding down the canopy! Actually, I manhandled it down, long and hot luckily 12/30 at Las Cruces is 7,500 feet. Let it roll to a stop and then drove it to the departure end of the runway. (Furthest from buildings and people). Stopped - knees weak could not latch the canopy. Opened it completely, latched it. TURNED ON THE MASTER - CHECKED THE SAFETY LIGHT AND BUZZER - turned around and took off on 12. Shot two more landings, took it to Las Cruces Aviation, met on the ramp by Joe Gold, illustrious flight instructor, and my brother who was about to go up in his Citabria. NO ONE EVEN NOTICED! but to me it was scary".

Shopping

New Long-EZ prefab parts available now from Task:
Long-EZ fuel/baggage/strake kit, includes ribs and baffles - 16 pieces. The kit is also available without ribs and baffles.

1 NG-31 Foam cut to plan and glassed both sides.
2 NG-30 Both laid up per drawings - predrilled 5 places.
1 F6 with overlaps formed as done on page 13-6
1 F22 per drawings including doubler and extra plies.
1 F28 Notched for assembly.
1 Instrument Panel, notched and drilled - except instrument and radio holes.
1 Front seat back - with notches and cut outs.
1 Rear seat back - with notches and cut outs.
1 FSRC formed 90 degree - trim and install (console)
1 RSRC formed 90 degree
1 FSLC - including 9.1" x 8" separate pc. per page 24-1.
1 RSCL formed 90 degree - Trim and install
1 Front thigh support, formed and glassed, 2 ribs included.
1 Rollover structure, formed, glassed rear closure insert included.
All of the above parts are vacuum bagged, prepreg, which results in lightweight, excellent-quality parts. We have a display of these parts at RAF. Anyone who may have purchased prefab strakes from Task, and do not have installation instructions, write to Task. For more information, send a SASE to:

Task Research,
848 East Santa Maria St,
Santa Paula, CA 93060
(805) 525-4445

We have had two of B & C Specialty's excellent little alternators on test for over a year now. The belt driven type for Lycomings has been running on the prototype Long-EZ N79RA for over 340 hours, and has been trouble free. The Continental, gear driven alternator has not missed a beat in the prototype VariEze, N4EZ for over 100 hours. Many of the alternators are installed in homebuilt VariEzes and Long-EZs, and we are not aware of any failures. Bill is to be commended for his excellent solution to our need for lightweight electrical power. Send Bill a SASE for a brochure with color photos.
B & C Specialty
518 Sunnyside Ct,
Newton, KS 67114
(316)283-8662

Note that Ray and Nova Cullen have moved, but are still available for anyone who needs assistance with Eze construction problems. Ray and Nova still continue to supply plans for seat cushions and survival kits for $8.00. Mike and Sally's N26MS seat cushions are done from a set of Ray and Nova's plans.
Ray and Nova Cullen
1607 First Street
La Grand, OR 97850

For Sale: VariEze Main gear and other parts.
Contact: Charlie Willwerth,
215 Froman Dr,
Summersville, SC 29483

For Sale or Trade: Long-EZ main gear strut. Wants VariEze main Gear.
Contact: Alan Laudani,
11929 W. Diane Dr,
Wauwatosa, WI 53226
(415)453-8575

For Sale: Clear Plexiglass canopy for VariEze or Long-EZ, new ex Airplane Factory, Dayton OH.
Contact: Er Grootes,
Madlasandnes 85,
4042 Hafrsfvord,
Norway.

For Sale: 108 hp O-235-C1 Lycoming, 60 hours SMOH plus all accessories. $2950.
Contact: Dennis Jacobs,
526 Ridgecrest Dr,
Yellow Springs, OH 45387

For Sale: Zero time O-235 Lycoming, for more information contact:
Ted A. Miller
1561 Fairlawn Street,
Oshkosh, WI 54901
(414)231-8232
This engine was overhauled through the Aviation Explorer Post 2692, Boy Scouts of America - all logs and parts replaced can be had from Ted.

For Sale: Continental O-200, still flying, total time 4070 hours, 270 hours STOH, includes starter, generator, mags, harness and carb. $2300.
Contact: Bill Spellman
(414)463-4255

For Sale: Continental O-200, firewall forward, all accessories. From a Cessna 150. 2400 TT, 1560 STOH. Logs, prop and mount $2495.

Continental O-200, from a Cessna 150, complete engine with all accessories and logs $1995.
Contact: Lee Heron,
c/o The Airplane Shop
Caldwell/Essex County Airport,
125 Passaic Ave,
Firchild, NJ 07006
(201)736-9092

For Sale: Continental O-200 rebuilt engine, (100 octane valves), new rod ends, pistons, balanced, zero time. Other parts available.
Contact: Halk Woolway,
1025 Palms Blvd,
Venice, CA 90291
(213)392-2295

Performance Flight Testing Lecture

This year at Oshkosh, Burt presented a lecture on basic methods to conduct performance flight tests and on data corrections and standardization methods. Many in the audience asked for a list of the equations used, so he promised to print them in CP #30. Room here does not allow a presentation of the total lecture with pilot techniques, but those who were in attendance will be able to use the information below: **EQUATIONS OMITTED**

The RAF Model 68 Amsoil Racer
In late 1979 Burt designed an aircraft for Dan Mortensen to fit the specifications for racing biplanes. In 1980 Dan received sponsorship from Amsoil to build and race a prototype. The aircraft (N3OILS), built by a team in Sacramento, California, was completed in August '81. It was entered in the 1981 Reno Air Races in September. Although it turned several record-exceeding laps during a heat race, it finished only third in the final race due to several pylon cuts. The pylon cuts were the result of a roll deficiency in the control system.

Dan delivered N3OILS to RAF in October so we could evaluate it and help him complete its development. Except for the roll deficiency, which was caused by inadequate travel and stiffness of the controls, the Racer has proven to be an excellent flying aircraft with good firm flying qualities at its 240 mph racing speed. It's takeoff and landing distances and handling are good. Dan plans to make some improvements in it's engine installation and propeller which should assure its racing success in the next season.

The Model 68 is very similar to the RAF Model 54 Quickie, using the reversed stagger tandem wing concept with wheels at canard tips. It uses some previously unflown airfoils, which have been now shown by test to be delivering over 60% chord natural laminar flow. The NLF is attained even within the prop wash!

Of particular note is the use of the small horizontal "T" tail. The tail is an all flying type and is geared to operate with the canard elevator control system. Note that this is the first use of a Horizontal tail on Rutan designed aircraft. Its purpose is to force the forward elevator to the proper positions to optimize canard airfoil camber for both the 250 mph straight aways and the 4g turns. Also, the horizontal tail fine tunes the aeroelastic effects to increase pitch stability at very high speeds. Despite the use of carbon fiber in it's construction, the Model 68 is a relatively flexible airframe for a 250 mph application. The design parameters for the tail were verified by the flight tests.

VARIVIGGEN NEWS by Mike Melvill

Oshkosh was 'big' this year. More people and planes than ever. But this year was special. There has been a VariViggen at Oshkosh for 10 years straight. The first six years were Burt's N27VV, the original prototype, now in the EAA museum, and then my Viggen N27MS, made its Oshkosh debut the following year and has been at the airshow for four straight years. 1981 was the first time more than one VariViggen was present. Ken Winter of Tulsa, Oklahoma, flew his very excellent Viggen

in and I had the pleasure of flying in formation with Ken in the fly bys. Ken also was kind enough to give rides to a lot of Viggen builders during the week. Hopefully, this will give those builders a shot in the arm so to speak, and they should have gone home and really gotten busy on their Viggen projects.

I flew my Viggen out to Oshkosh and back. Our route took us Mojave to St. George, Utah, to Aspen, Colorado. Spent the night there and departed the next morning with a density altitude of 10,800 feet, climbed over the Divide west of Boulder, Colorado and flew to Hastings, Nebraska. From Hastings to Bascobel, Wisconsin and to Oshkosh. After Oshkosh we took the long route home via Anderson, Indiana, to Joplin, Missouri, to spend the night in Abilene, Texas. Next morning on to Alamagordo, New Mexico where we visited with our eldest son. From Alamagordo we flew via Albuquerque, Farmington, Monument Valley to Page, non stop. From Page we flew the Colorado river and over the Grand Canyon, then back home to Mojave. We covered 4600 miles and I put 35 hours on the tack. The Viggen required 2 quarts of oil, and that was all. My Mother was my back seat passenger, and she really enjoyed her trip in the Viggen. She says the Viggen is the greatest (but she may be biased!).

We almost had a third Viggen at Oshkosh. Arthur Schwartz started for Oshkosh and got as far as Youngstown Ohio, and was turned back by low visibility and rain. Arthur was keenly disappointed in not making it to Oshkosh, but reports that he has 116 hours on his airplane. He has flown in and out of all kinds of airports in various weather conditions, including 90 degree crosswind of 20 knots, without difficulty.

He reports another bonus of being a Viggen flyer - when you land, the crowds gather, people take pictures, and even want your autograph!, so he says to all VariViggen builders who have been taking it easy, and not working on their birds to "get busy and sample the pleasure and ecstasy with the feeling of having something unique, matchless and most beautiful".

Leonard Dobson made his first flight in his Viggen, shown in CP29, on August 1st, 1981. He was not able to make it to Oshkosh, but he is having a great time flying his time off. His letter is printed below.

Terry Galbreath reports that he is making good progress and expects to have his Viggen on the gear by Christmas. Terry had been to Washington Hardware and got about 30% of his bolts there and says that you should take a bolt gauge with you.

Frank Stites sent a photo of his Viggen, and it requires only wing fuel tanks and canopies and it is ready. It looks excellent. Frank has the composite special wing. Arthur Schwartz flew up to visit Frank a week or two ago, so that should motivate Frank to get her in the air!

Keith Armstrong has requested that we have a VariViggen bull session at Oshkosh next year. I agree, Keith, and we will set something up. This year the builders organized something themselves, but unfortunately I was so busy with other RAF duties, I was unable to be there. Keith reports that he used "constant force" springs for the helper springs in his main gear. These are similar to what I used, and mine have worked

perfectly. The biggest drawback to this type of spring is the price. You can obtain more information from:

John Evans Sons Inc.,
Springs Ave.,
Lansdale, Pa 19446
(215)368-7700

Keith used part #R433W and found that two per side were required.

The following is "Dobby" Dobson's report:
FIRST FLIGHT: The event was purposely kept low key, with no advance publicity on date or time. I had two fellow EAA members who were familiar with the Viggen to assist me. They each inspected the aircraft, and checked my weight and balance figures. They also made sure that I used my check list for pre-flight before they turned me loose, and got in the chase plane. At approximately 9:00 am, August 1st, '81 three years and one month after the start of construction, Rutan VariViggen N73LD serial #533 lifted off at Georgetown, Texas airport. Some preliminary "pilot induced oscillation" and wing rock caused by nervousness and heavy handed input made the take-off a little wild. However, I established a rate of climb at about 800 ft per minute, levelled off at 3000 feet and then took a few seconds off to congratulate myself on my achievement so far. I did not retract the gear during this flight, and kept the speed below 120 mph. I spent the next thirty minutes getting acquainted with the airplane, and then made two simulated approaches and landings at altitude. Cylinder head temperature had been running on the high side to I decided to terminate the flight before I had completed my program. The landing was interesting. It is very difficult to break the habit of years of making stall landings. 2000 or so hours in Cessnas, Pipers, and Beeches doesn't make one an expert in a Viggen! Finding the correct pitch attitude is the tough part. I have an angle of attack indicator, but by the time I get it calibrated, I probably won't need it any more.

Second Flight: Was much more enjoyable because I was relaxed. Take-off and landing were beautiful. Handling in the air was delightful. My wife was a passenger in the chase plane, and she described the flight as that of a graceful yellow butterfly. Gear retraction and extension worked perfectly, and engine cooling was much better. (I had improved baffling). After 20 hours of flying time I have some observations, impressions, and advice for what it may be worth to some of you Viggen builders.

1. High speed taxi test and lift-offs: I found that a 4000 ft runway was not long enough for me. On my last run, I had to use a rough over-run to stop, and it was a helluva way to test the gear!
2. Brakes: Go back and read Mike's article on brake and master cylinder compatibility in CP #23 Page 9, I made the same mistake Mike did, and I should have made the correction when I first read about the problem instead of verifying it in my own aircraft.
3. Preparation for First Flight: Make every effort to get some time in a light weight homebuilt that has extremely sensitive controls. If you can fly a canard pusher, so much the better. If you can fly in the front seat, you have it made. Sit in the front cockpit of your Viggen with the fuselage propped up to about a six or seven degree angle, and pick out something in the cockpit, or put a mark on the canopy, so that you have a ready reference for that pitch angle.
4. Squawk Sheet: Correct any problems after each flight, or before flying again. Don't let them pile up. Nobody says you have to fly the

restrictions off in a week or a month. Use the time to "fine tune" your airplane.
5. Program your test flights. My Viggen costs me about $18 per hour to fly just for fuel. That amounts to $720 to fly off the restrictions. I intend for it to be a worthwhile expenditure, by making up my own flight manual on performance and flying characteristics, instead of just aimlessly flying around in circles.
6. Handling: I have heard and read many stories of homebuilders praising the ability of their creations to fly "hands off". My Viggen is not a "hands off" airplane. I neither wanted it to be or expected it to be in that category. Either I fly it or it will fly me, but I love it. I tweak the stick in any direction and it responds! It goes fast and it goes slow. I am constantly amazed at the abrupt, sharp turn capabilities. The first time I felt the tiny little nibble of the canard as it stalled, I laughed out loud like a kit with a new toy.
7. Viggen Production: Plans for the VariViggen have been available since 1974, but very few airplanes have been completed and flown, and that is too bad. Sure it's a complex airplane to build and sure it's not cheap, but it has sure been a worthwhile project. My Viggen is not a Grand Champion or even close to it, but

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it sure draws a crowd. Hundreds of people have admired it both in the air and on the ground. I have approximately 50 requests for rides when the restrictions are flown off. Included in this group are a number of corporate pilots who fly Gulfstreams, Lears, MU-2s, King Airs and 421s. These are pilots who have to wear neckties when they fly, and generally don't get overly enthusiastic about any airplane.

I can only hope that this report from an enthusiastic youngster of 68, will get some of you guys back on the stick and finish your Viggens.

Statistics of N73LD:

Engine:	Lycoming O-360 A1D 180 HP
Prop	Hendrickson 70 x 70 Wood
Empty Wt:	1236 lbs.
Gross Wt:	1860 lbs.
Fuel:	Main Tank 30 gals. Wing - 6 gal each
Range:	650/700 miles
Wing:	Standard, composite construction with full span ailerons.

Thank you Mike and Sally for all your help, and also thanks to Burt for a good design and support during construction.
A special thanks to Jim Cavis of Scottsdale for getting me started on the Viggen project. Please, Jim, finish your airplane - you will love it.

Yours sincerely,
Leonard "Dobby" Dobson.

For Sale.
Lycoming O-360 180 hp. Zero since chrome major. New alternator, reconditioned magnetos. Can be either carburetor or fuel injection.

Contact: James Belt
18912 Silver Maple Way,
Santa Ana, CA 92705 (714) 730-5835

Lycoming O-360A1A 180 hp Fresh major.
Contact: Dewey E. Straley
488 Fairfield Ave,
Gretna, LA 70053 (504) 362-8482

VariViggen project for sale
Contact: Mrs. M. Crozier,
1233 Dogwood,
Chesterton, IN 46304

Don Crozier was quite well into his Viggen project and had lots of parts to complete the airplane. Don passed away recently and Mrs. Crozier would like to sell the whole project.

For Sale: VariViggen project, 1st edition plans with all updates, spruce kit, fiberglass parts, wing attach fittings, 500 x 5 wheels and brakes, master cylinders and brake pedals. Will trade for Long-EZ parts and plans.
Contact: Ron Lorimor (415) 967-0613

For Sale: VariViggen project. Plans, construction manuals, owners manual and tech. report. Fuselage 80%, canopy, cowling, wheels, brakes, etc. Much more.
Contact: Al Lechifflard,
1025 31st ave., SW
Vero Beach, FL 32960 (305) 569-2629

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dobby Dobson with N73LD.

Frank Stites' Viggen complete except the wing fuel tanks and winglets.

Dobby's well-equipped panel.

Gene de Ruelle's instrument panel in his Viggen.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This highlighted photo shows the extent of laminar flow on the Model 68 Amsoil Racer. Note the loss of laminar flow caused by the strut transition and by several specks and insect strikes that cause a turbulent wedge of 15-degree angle.

The Model 73 scaled-demonstrator of Fairchild's Next Generation Trainer proposal. Note its small size. At 842 lb. empty, and 21.8-ft span it is probably the worlds smallest twin engine jet.

A portion of the grounds at Oshkosh. Guess where the Long-EZ forum is being held!!

NASA's Phil Brown and Bruce Holmes documenting the patterns of boundary layer transition on the canard of the Amsoil Racer. Note the small horizontal "T" tail.

Mike Melvill is at the controls of the "RAF jet" here on its third test flight. The complete, instrumented engineering flight test program (except spins) was completed at RAF in an incredibly fast 15-day time period. The all-composite, moldless-construction prototype flight demonstrator concept is proving to be a valuable, economical engineering tool for aircraft development.

Three Long-EZs in the flyby pattern at Oshkosh.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Jim Carlin and co-pilot (Lakeworth, FL.) getting some early stick time in their Long. Jim's workmanship is superb.

George Gilmer with his EZ, based at Santa Paula, CA. George is 74 and has been flying since 1928! George built all the parts of this EZ, including wheels and brakes.

The mostly-alert group of EZ builders, watching the construction video tape at Charlie and Betty Gray's meeting in Florida.

John Denver at Oshkosh shortly after his flight in the Long-EZ with Mike Melvill. His assessment of Mike's Long "farr-out!!" Photo by Bill Ebken.

Bob Woodall's EZ on display at the National Air and Space Museum, Washington, D.C.

Charlie Gray's Long fuselage in the assembly stage. Note the blocks on the flat table to hold the sides in symmetric alignment. Also note the mid-section bungee cord to hold things down and in for cure.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.
Empty Basic	710 lb.
Empty Equipped	750 lb.
Solo Weight	960 lb
Gross Weight	1325 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	550/830 ft
Climb (solo/gross)	1750/1350 fpm
Cruise 75% 8000 ft	183 mph

Cruise 40% 12000 ft	144 mph
Max range * 75% (solo/2 place)	1370/965 mi
Max range * 40% (solo/2 place)	2010/1430 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200
SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order. Newsletter not taxable.		
TOTAL		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $3

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $3

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Sally Melvill taxiing out for first Long-EZ solo flight.

Long-EZ parked nose-down with two VariEzes.

The nose gear retracts for parking and in flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

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Sublimating chemicals applied to the Long-EZ wing and vertical fins show the extent of laminar flow. Note that turbulent flow is induced when the paint trim strip is located aft of 5 percent chord on vertical fin.

CP30, Page 18

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Overseas (Airmail)	$8.75
Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 31. If you are building from 2nd Edition plans you must have newsletters 18 through 31. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 31. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 31. If you are building a Long-EZ you must have newsletters from 24 through 31.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes.
Reproduction and redistribution of this newsletter is approved and encouraged. The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 on Saturday.
Closed Sunday.
If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

Saturday Demos
Saturdays from 10:00 am to about 2:00 pm have been very busy with from 30 to 100 visitors showing up at the shop. Generally we have the VariViggen, the VariEze and two Long-EZs on display. We have been showing the construction video tape plus a very entertaining tape of RAF planes flying formation. We then generally have a "bull session" answering any builder or pilot questions and wind up with flying one or all of the airplanes, at around 1:00 pm.

RAF ACTIVITY
Since CP 30 has involved: Completion of our Model 73 jet flight test program, fabrication of our self-launching sailplane prototype,

completion and rollout of our new STOL research aircraft, hosting our annual workshop and providing homebuilder support.

RAF MODEL 77 SAILPLANE IS NAMED
Our entry in the SSA contest for a self-launching sailplane now has a name - SOLITAIRE. The Solitaire is a single-place sailplane with the intended capability to self launch, with a fixed engine and a retractable propeller. Its tandem-wing configuration allows the pilot to sit at the cg, eliminating the cg shift due to pilot weight that is common with standard sailplanes. The Solitaire has a 12.5 meter wingspan. If flight tests planned to begin next month are successful, the Solitaire will be offered for homebuilder construction. It will be marketed similarly to the Long-EZ, not as a complete kit. This results is considerable cost savings to the builder for materials. Also, the builder has the option of building or buying the prefab components. Further information on Solitaire will be released after it is flying, but in the mean time, please don't ask - we're very busy with the completion and test program.

For Sale At RAF
We do have the main and nose gears in stock. The main gear is shipped Greyhound bus, freight collect.

Main Gear	$309.00
Nose Gear	55.55

Canopies for pickup at RAF are taking about 2 to 3 weeks to arrive. We are not really keeping these in stock as we do have a storage problem. If you wish to pick up here at RAF, we will order for you and let you know when it comes in.

Bronze or Smoke	$249.00
Green	229.00
Clear	199.00

The new RAF patch (see photo) introduced at Oshkosh '81 is available from us. The large patch is $2.50 and the small patches are $1.50 each. The small patches are available for VariViggen, VariEze and Long-EZ.

The Long-EZ, VariEze and VariViggen silver belt buckles come in both mens and ladies sizes and also brushed finish or shiny. They are hand made in silver, from New Mexico. $25.00 each.

Video Tapes - Building the Rutan Composites.
This tape shows you the "how to" with composites. It is a great help for first timers as well as experienced builders. When ordering your tape, please specify whether it is VHS or Beta II. $59.95 plus $4.00 for postage.

Go-A-Long-EZ is a tape that covers the checkout, weight and balance of your aircraft, how to conduct the taxi tests and first flight.
$49.95 plus $4.00 for postage.

Orders for the Construction tape from overseas customers should be sent directly to the address below. Ferde will convert the VHS or BETA to the PAL system for you. At present he is only doing the construction tape.
Ferde Grofe Films,

702 Washington St.,
Suite 168,
Marina Del Rey, CA 90291

RAF BUILDER SUPPORT
It has become necessary to further clarify Rutan Aircraft's position in relation to the homebuilder and the support we give. Rutan Aircraft can only offer the assistance that helps them interpret the plans when they desire to build their aircraft like the prototype we have tested. We cannot assist in the design and construction of modifications. We cannot comment on the advisability of modifications. Many of the developments we design and test do not work as predicted. Thus, without testing your idea we cannot reliably predict its success. A similar situation exists for substitutions of materials. We will not be able to advise you on any material we have not tested ourselves.

LONG-EZ ACCEPTED
For amateur construction in Canada. Thanks to much hard work by the EAA Canada, in particular Edward Slack, the Long-EZ is now accepted by the Canadian DOT for amateur construction. Maximum take off weight allowed is 1325 lbs.

LONG-EZ FIRST FLIGHTS
The following is a list of all the Long-EZs flying that we know of. If you know of someone who has a Long-EZ flying, please send us his or her name, address, N-number and date of first flight.

Burt Rutan	CA	N79RA	June	1979
Johnny Murphy	FL	N21VE	June	1980
Mike Melvill	CA	N26MS	Dec	1980
Dick Rutan	CA	N169SH	Apr	1981
Richard Sparkman	FL	N506EZ	June	1981
Dan McElroy	WA	N80DZ	July	1981
Neil Hunter	FL	N141NH	Oct	1981
Ray Olsen	MN	N42DR	Oct	1981
Jerry Gruber	IN	N401EZ	Nov	1981
Harris Howard	TX	N25HC	Dec	1981
Robert Hansen	CA	N7LZ	Jan	1982
Joe Enrico	CA		Jan	1982

Many more Long-EZs are close to completion. By the time Oshkosh comes around, Long-EZs may even be close to VariEzes in number on the flight line!!

RAF MODEL 72, GRIZZLY ROLLOUT
The Rollout - On January 14th, 1982, at the Mojave California Airport, Rutan Aircraft Factory Inc. rolled out their latest prototype, the RAF Model 72 Grizzly. The new aircraft is a proof-of-concept prototype to be used to evaluate the feasibility of achieving STOL and amphibious capability with a canard/tandem-wing configuration.

Amphibious Floats - The aircraft will initially be tested in its bush configuration with four low-pressure tires on the main gear for soft or

unprepared fields. It will later be fitted with a new type of amphibious float system to allow it to operate from either water or hard-surfaced runways. The goal of the new float system is to allow operation from land to lake and back without the requirement to raise or lower wheels or to operate a water rudder. Schedule for testing the amphibious system will depend on the success of the flight test program with the bush configuration.

The Grizzly Details - The Grizzly is a four-place with a large baggage area. Power is the IO360-B, an injected 180 bhp 4 cylinder Lycoming. The prop is a constant-speed two-blade Hartzell. The sliding canopy has bulging side windows, allowing straight-down visibility for the pilots. Fuel is carried in the wing interconnects, keeping fuel away from the cabin while providing the torsional bracing required for the forward-swept wings. The four Fowler flaps average over 50 percent chord, adding over 45 square feet of wing area when deployed. The Grizzly airfoil and wing systems are the first to be developed by a new RAF aerodynamic design computer program which handles the complex interactions of tandem wings and high-lift devices. The structure is all composite, using fiberglass and carbon fiber facings/reinforcements with rigid foam sandwich cores. The Grizzly airframe is a test bed for evaluating and comparing several structural configurations. For example, the right wing is a hollow, sandwich-skin configuration and the left wing is the full-core construction technique pioneered on the VariEze. It's interesting to note that not only did the full core wing require far fewer man hours to build, it is also lighter and stiffer than the hollow wing. To enhance the go-anywhere, land-anywhere capability of the Grizzly, its cabin converts to sleep two, for camping. Folding the rear seat forward results in a level, 78 inch long bed.

The Grizzly Purpose - The Model 72 prototype is not intended for a specific market. RAF plans no certification/production of this model and it is considered too large for the homebuilt market. The purpose is research, to study canard aerodynamics in the STOL category. Our previous canard aircraft have not been designed for short-field operation. Thus, many have concluded that tandem-wing aircraft may not be suited for STOL performance. We do not have the definitive answers to this subject, but hope to gather the necessary data during the Model 72 test program to considerably expand our technology base. We expect the knowledge gained by testing this proof-of-concept aircraft will be invaluable for future developments.

Not on Public Display - The Model 72 prototype should be visible undergoing extensive testing at Mojave and at other required sites. However, it is not on public display at the RAF facility since it is housed at a remote hangar. Grizzly has not been and will not be our highest priority - we will continue to concentrate on our homebuilt programs, the Model 61 Long-EZ and our new self-launching sailplane, the Model 77, Solitaire.

OSHKOSH 1982 - Those of you who will be making the pilgrimage to Oshkosh this year should note that the Hospitality Club banquet will held at the Anchor Inn on Sunday August 1st 1982, not on Wednesday as it has been in the past. The annual banquet is limited to Hospitality Club members or to those actively flying a VariEze or Long-EZ. For

information on the Hospitality Club write Don and Bernadette Shupe, 2531 College Lane, Laverne, CA 91750.

Camping at Oshkosh - Those EZ pilots flying in and wishing to camp can reserve a camping trailer (sleeps 4 to 6) which will be parked in Paul's Woods the week prior to the flyin. The cost is $150 per trailer, payable at least one month before August 1st, plus cost of registration and camping fee. There are only 8 trailers available, and reservations are on a first come, first served basis.

Contact: Nat Puffer,
2182 North Payne Ave,
St. Paul, MN 55117

Irene "Mom" Rutan, official historian for the VariEze Hospitality Club, requests that all VariEze and Long-EZ pilots send her a photo and information on their airplane as soon as possible after first flight.

Send to: Irene Rutan,
8526 Calmada,
Whittier, CA 90605

VARIEZE/LONG-EZ CLUBS

Jerry Gruber, who recently flew his beautiful Long-EZ, has offered builder assistance to anyone in his area. Contact Jerry at 401 Aspin Dr., Elkhart, Indiana 46514

John Steichen of Downers Grove, Illinois would like to hear from builders/flyers who would be interested in some form of Great Lakes or Midwest hospitality activities. John is willing to organize a winter or spring flyin/drive in. Contact

John Steichen (N27EZ),
Brookeridge Air Park,
960 86th Street,
Downers Grove, Illinois 60516

SAFE-T-POXY - REACTIONS, ALLERGIES

It has come to our notice that quite a number of builders seem to be suffering from some form of reaction to the Safe-T-Poxy. We are very interested to know the present scope of this problem, since initial results in 1978 showed that reactions were very rare. If you have had any kind of reaction to the Safe-T-Poxy, please send us a report with a brief description of the reaction, and how long you had been working with the material before you noticed the reaction, whether or not you were using any form of protection, gloves, Ply 9, respirator etc. We will correlate this information and work closely with the manufacturer to see if a change has occurred or if improvement is indicated. We will report on our findings in a future C.P.

FOAM PREPARATION

Although we have had this correction in at least two previous newsletters, some builders are still not using micro slurry. ALL foam should be slurried. Disregard ANY and ALL statements in the Long-EZ plans that say not to use slurry. By slurring the foam, you will be able to do a better quality, lighter layup, in less time.

Slurry fills the broken cells on the foam surface. After spreading slurry on, wipe off excess with the squeegee to that only a thin film is uniformly spread over the entire part. The construction video tape is a good reference for good slurry technique. If in doubt, send RAF a sample of your work for our comment (include a SASE, of course).

If you have already made some of your parts without slurry, it is not necessary to remake them, provided you have met the dryness criteria. If they are very wet, or too heavy, you might consider doing them again, however lack of slurrying is not cause for structural disqualification.

PARKING YOUR EZ
It does not seem possible, but there are still VariEze and Long-EZ builders out there who apparently are not aware of the fact that this configuration of aircraft will fall over on its tail if it is left unattended while the nose gear is extended. The pilot is required in the front seat to balance the airplane to the correct cg. Should the pilot climb out and let go of the airplane, it will fall over on its tail, and this can result in a broken prop or at least damaged winglets. This condition is unavoidable. The main gear position is a direct function of rotation speed. Ballasting the nose to overcome this will result in unacceptably long take-off rolls, and a very difficult airplane to handle on the ground. This is the main reason that the nose gear retracts. This allows you to park the airplane nose down, which is a very stable way to park and avoids the requirement for a wheel chock when untied in winds up to 35 knots.

BUILDER-INITIATED CHANGES
This is an item that needs to be put into perspective, since we often answer questions and often observe activity that we consider questionable. First, we do recognize that you are the manufacturer of your aircraft and that if you do not agree with us on specific details you have every right to modify, redesign, substitute etc., on your aircraft and to then take the risks of trying something new and untested. We do recommend only that which we have tested, since it is the only configuration we know is adequate and, by our own experience we can report on and support.

Any builder (at least U.S. builder) has the freedom to build his own aircraft exactly as he sees fit. Changes he makes will be opening up new areas not substantiated by test. We have no argument with this. However, if he makes recommendations to other builders on a change that he likes, but has not verified by test, he should realize that he may be liable for loss or injury caused by that change.

If, for example, you recommend a larger engine or a substitute of an inferior foam core to someone else, without fully qualifying and testing the many design changes that may be required, you must remember that those builders are now counting on you to be right and that your responsibility is then extended beyond your own risk with your own airplane.

MODEL 73 TEST PROGRAM COMPLETED - The RAF Model 73 is a scaled flight demonstrator of Fairchild Republic's proposal for the Air Force's Next Generation Trainer (NGT) program. In early 1981, Fairchild Republic contracted Ames Industrial Corp. (builder of the RAF Model 35, AD-1

skew-wing jet) to build the scaled flight demonstrator. Fairchild supplied accurate lofts of the external shape of the NGT design. Ames hired RAF to design the structure and systems and to conduct the flight test program. The scaled demonstrator is 62 percent of the size of the full scale aircraft.

The design and prototype construction effort took eight months. The aircraft was shipped to RAF in early September 1981. Within eight weeks RAF accomplished all the following tasks: flew four qualitative flights, coordinated the installation of a telemetered instrumentation system, flew 14 stability and control flights, developed and tested a spin recovery parachute, measured and ballasted the three-axis moments of inertia, developed a fuel transfer system for cg control, designed and incorporated several modifications, reduced, analyzed and presented all flight test data, wrote the qualitative flying qualities results, conclusions and recommendations, prepared a 220-page test report and an oral/video tape/slide presentation of the results. Working on a tight schedule, the final report and presentation was presented to Fairchild seven days after the last test flight. The use of the manned, scaled flight demonstrator produced higher quality data than other methods, particularly for areas such as spin susceptibility and departure recovery. The scaled flight demonstrator was built within a schedule and cost framework that compared to conventional static-only wind-tunnel programs. However, the added benefits of dynamic stability data and pilot qualitative information resulted in considerable improvement in the value of the findings. The structure of the Model 73 is the moldless composite sandwich method, using oriented uni-directional carbon fiber or fiberglass for facings and spar caps and rigid closed-cell foams for core.

NEW COMPANY, SCALED, INC. TO DO RESEARCH PROJECTS
Since the successful completion of the Fairchild 62% NGT program in November '81 there has been a great deal of interest in RAF's capability to design, develop, fabricate and flight test new aircraft concepts at low cost and short schedule. Because of this interest, Herb Iversen, General Manager of Ames, the company that built the NASA AD-1 and the Model 73, is forming a new company to deal exclusively with this new type of business. Burt will do the design work and the flight testing for the new company. No changes are planned for RAF. RAF plans to continue to support builders of RAF-designed homebuilts and to develop new designs for homebuilders.

The new company will be called SCALED, Inc. The SCALED is, in fact, any acronym for "Scaled Composites: the Advance Link to Efficient Development". Pat Storch spent several late nights and the better part of a carafe of white wine to come up with that name!

SCALED will be based on Mojave Airport next door to RAF. The new facility will conduct the entire program of contracting, design, fabrication, testing and reporting. Proposed customers for SCALED include any agency requiring aerodynamic, systems or structural research data early in the development cycle. To date, proposals include next-generation general aviation designs, commuter airliners and military applications.

SCALED INC., NEEDS HELP - SCALED Inc. who will be involved in designing, building and testing proof-of-concept demonstrator aircraft

similar to those RAF and AMES have collaborated on in the past are looking for charter members for their new staff. We're currently looking for some shop help, a computer fanatic, a flight test instrumentation technician and a French speaking secretary/receptionist (word processing experience helpful). Also needed turbo-jet, turbo-fan engineer/manager. Needs to have 10 years experience with turbo-jet/APU, overhaul/repair.

If you are more concerned with interesting, challenging work than in civilization and culture, you might consider a move to our Mojave Desert to get in on some real stimulating projects. Send resume to:

Herb Iversen
c/o Rutan Aircraft Factory Inc.
Bldg 13, Airport
Mojave, CA 93501

CP31, Page 3

BUILDER HINTS

We have recently tried an excellent substitute for featherfill. This product is a two part polyurethane primer filler and is manufactured by: Sterling Lacquer Mfg. Co, 3150 Brannon Ave, St. Louis, MO 63139 (314)776-4450. Contact the above for a local distributor in your area. Sterling primer filler (part # U-1761 and U-1762 and U-1014 thinner) is a high solids primer with excellent sanding and film thickness building properties. We have used it with up to 20% by volume mixed with micro balloons and were still able to spray it. It can also be brushed on. The good news is that it cures very rapidly, 45 minutes to 1 hour and sands nicely to contour. It also adheres very well. The bad news is the price. This is an expensive material, the price seems to vary considerably depending on where you are located.

When applying Spraylat to your canopy for protection, be sure to get a good thick coat, preferably 2 or even 3 coats. This will make it much easier to remove. Also, if you spill epoxy on the Spraylat, wipe it up with a paper towel before it cures. If it cures, it will not damage the plexiglass, but it does make it very difficult to remove the Spraylat locally.

A 3M part #7770 Clean'n'Strip brush, mounted on your drill really does a super job of carving the R45 dark blue foam. As an example the bottom can be carved and ready to glass in only 45 minutes. Thanks to Don Jehlik for this one.

When knife trimming, hold a strong light under the glass overhanging to more clearly show where the edge of the foam is.

Long-EZ Clarification

Section I, page 19-8.
Lay up #5 is one ply of UND per leg of the "V" layup. (2 plies over the shearweb face).

Caution - Damage From Brake Heat

Do not conduct your taxi tests, high speed taxi and first flights with wheel pants installed. You will be using far more brake during this

period than is normal. See Long-EZ Owners Manual, page 41, under low speed taxi.

If you do have wheel pants installed, it is possible to generate enough heat buildup to soften the main gear strut and cause it to sag/fail.

Long-EZ and VariEze - Glue a piece of fiberfrax on to the outboard face of the main gear strut to protect the strut from local heat radiation from the brake disc.

If your control sticks have any lateral slop, try substituting AN174-20 close tolerance bolts for AN4-20 pivot bolts in the control handles.

Balancing Long-EZ ailerons. Several builders have reported having a problem in this area. If you are having difficulty with this, double check your hinge pivot is exactly correct, in most cases this has been the problem. When building your wings, keep the aileron as light (almost dry) as possible. Install the balance weight in the correct relationship to the hinge. Some builders are getting the weight too close to the hinge. See Section I, page 19-14 for full size sections.

When you install your wheels, spin them and check the disc for runout/wobble. It should run true, within .010". If not true it can force the brake caliper piston back inside the caliper, and then you may have to pump the brakes once or twice before you get a solid brake.

If you are experiencing gear "walk" or shudder as you roll out to take off or land, particularly as you brake to slow down, you should balance your wheels and tires. An out of balance condition that may not be noticeable on a factory built, may be objectionable on a VariEze or Long-EZ due to the relatively flexible gear strut.

Many builders have enquired about the relief tubes that are installed in N26MS and in the prototype N79RA. Here is a brief description of how we did it. We used 5/16" ID x 3/8" OD plastic line from the local hardware store. We left it about 2 ft. long in each seat and ran it down the length of the fuselage through the aft seat bulkhead to the trailing edge of the gear. Then is was run down the trailing edge of the gear and left long enough at the bottom of the gear to protrude out of the wheel pants. The brake line was run down aft of the relief tubes on the trailing edge of the gear, to help fair in the gear strut. **SKETCH OMITTED**

After you install your wheel pants, drill a 3/8" hole in the aft bottom of the wheel pant and run the relief tubes out about 1 1/2 " through this hole. **SKETCH OMITTED**

We coil up the excess 24" or so and stow the coil in the front seat on the left side behind the static port line, and in the back seat, under the right console. To use the relief tubes, uncoil them and plug a rectangular plastic funnel into the end of the tube. The funnel is kept in a zip lock bag in the center section spar. To keep it and the relief tube clean and fresh, rinse out with a mixture of vinegar and water. **SKETCH OMITTED**

We had always had a small oil slick on the cowl from the breather on our Long-EZ, not enough to notice any oil loss on the dip stick, but

enough to be unsightly and aggravating. We cured this by running the breather line forward and up to the top of the forward engine baffle, looping it around and back down and aft to the normal breather exit shown in Section IIL. This necessitates using about 4 feet of 3/4" ID x 1" OD hardware store vinyl tubing. This is tied to the forward baffle brace and the engine lift point. To assure that this tube would not kink and pinch closed, we installed a 5/8" OD screen door spring, stretched out til the coils are 1/2" apart, inside the vinyl tube. This works like a separator, and even after a long flight, we have a clean cowl.

Caution - When floxing the top of your VariEze fuel strakes into place, be careful that excess squeeze out of flox does not drip down onto the screen, drip through and fall onto the open end of fuel pick up tube.

Caution - Exhaust system modifications, particularly those causing large bumps on the lower cowl (like cross-over or muffler-under-engine) can result in a performance loss as great as 15 mph due to aerodynamic drag, caused by airflow separation aft of the cowl modification.

Caution - Nose gear crank systems on both VariEze and Long-EZ, must have the two NG14 heavy wall aluminum tubes installed. These parts may not have been included in your nose gear actuator assembly from Brock.

Caution - Nat Puffer would like to share a problem that he has run into. He bought an engine mount and a cross over exhaust system from a supplier (not one of RAF's designated suppliers) and has had problems. The supplier has refused to make good or to refund. Nat is a member of the VariEze Hospitality Club, and anyone interested in the exact nature of his problems should contact Nat Puffer.

Caution- Oil pressure line should have an orifice fitting at the engine end. We have not been able to find a source of these fittings, but we have made up an acceptable substitute by making a small plug for the pipe thread end and drilling a #60 hole in it, installing it in the AN fitting and staking it into place.

Warning: Possible fatigue or installation failure of aluminum fittings in engine plumbing. We have had failure reports of aluminum fittings that support hoses or transducers on the vibrating parts of engines. This is a very serious concern, requiring us to recommend a grounding change that replaces certain fittings with equivalent steel parts. Refer to the plans-changes section of this newsletter for the new fittings. Do not fail to install the new steel parts, a failure can be fatal.

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting

the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

VariEze and Long-EZ

Owners Manual
Under engine failure, add "CAUTION, in weather conditions where carb ice is likely, descents should be made with as high a power setting as possible in order to keep the maximum available carb heat. Descent at idle power will allow carb heater (exhaust system) to cool down such that inadequate heat will be available should the carb ice up. This is particularly true when using any of the Continental engines".

VariEze Plans Changes

Owners Manual, Page 39
Under annually or each 100 hours, add - Jack aircraft up so that both main wheels are clear of the ground, and check for attachment wear by moving each wheel fore and aft - there should be no apparent excessive movement. If wear is present either bush the aluminum extrusions or drill out to 5/16" for AN5 bolts.

Fuel Cap Retention.
Geoff Danes from Australia, reports a lost fuel cap experience, with a cap secured to the cross wire by a short length of brass bath tub plug chain. Contrary to our previous fears of the cap flailing and damaging the top surface of the strake, very little damage occurred. Thus we are recommending that all fuel caps be attached to the cross wire with a length of brass "hardware store" chain as shown. Keep this chain as short as practical.

MAN/GRD 25 hours

VariEze oil pressure line - if you have substandard fittings and hose on your system, change it to that shown on page 8 of this newsletter.

MAN-GRD 25 Hour
At each end of the flex line from the gascolater to carburetor (see page 4 of this newsletter). Remove the following aluminum fittings:

AN822-6D	1
AN816-6D	1

Install the following steel substitute fittings:

AN822-6	1
AN816-6	1

Long-EZ Plans Changes

LPC #88 MEO, Section I, page 19-16.
Part #CS127 is made from .032 2024T3 aluminum.

LPC #89 MEO, Section I, page 9-3.
Sketch on lower left of page shows brake line run between the gear strut and brake disc. This is incorrect. The brake line must run around the inboard face of the strut. This puts the strut between the brake disc and the brake line.

LPC #90 MEO, Section I, page 20-4.
Step 6, says see Section III, this should read, see page 22-3.

LPC #91 MEO, Section I, Chapter 19.
Covers for the access holes, three each side, for wing attachment can be fabricated out of .016 aluminum sheet, painted to match you airplane. To install, stick over the hole using a small bead of RTV (silicone, clear silicone rubber sealant by Dow Corning is best). The covers should be taped or weighted into position and left to cure for at least 24 hours. They are water-tight and keep the rain out of the attach area. If you need to remove them later, a razor blade will easily cut them loose. **SKETCH OMITTED**

LPC #92 MEO, Section IIL.
Oops! We neglected to cover installation of the ram inlet scoop. This prefab part should be installed onto the bottom cowl, permanently. It is floxed into place, and has a flush "pop" rivet approximately every 2" around the flange. After cure, one ply of BID is layed up inside lapping 1" onto the cowl and the ram inlet.

LPC #93 MEO, Section IIL, page 36, bottom left.
AN823-4D should be AN816-4, also aeroquip 496-4 should be 491-4.

LPC #94 MAN-GRD, 25 HOUR.
Remove the following aluminum fittings:

AN822-6-2D	2
AN816-6D	2
AN823-6D	1
AN912-1D	1
AN823-4D	1

Install the following steel substitute fittings:

AN822-6-2	2
AN816-6	2

AN823-4	1
AN823-6	1
AN912.1	1

Refer to the adjacent circled items from Section IIL, page 36 to identify effected parts. Make the appropriate changes to Section IIL, pages 13, 18 and 37.

ACCIDENTS AND INCIDENTS

The CP Newsletter reports accidents and discusses their conditions and causes, for information purposes for all operators. We have always investigated accidents in the interest of determining information that we can disseminate to you to prevent recurrence. It should be recognized in our discussion of accident conditions or causes that generally this information is preliminary since it is published before the availability of the FAA accident report.

Long-EZ - Runway And Visibility

A Long-EZ crashed on takeoff from a small Minnesota airport. Conditions were clear, it was dark (about 1 hour before sunrise),the runway was hard surfaced, but covered with ice and snow, some large lumps of ice up to 4" thick. The runway was 2,000 ft. long and ended near the edge of a lake. The aircraft was in excellent condition with approximately 60 hours total time, with 5 hours flown the previous day. It had been hangared and had no frost on the wings, however an eye witness reported that the canopy was frosted over on the inside such that he was unable to see the pilot just before take off. The pilot commented that it was no problem because his experience was that the canopy would clear as soon as he had some speed. It appeared from wheel tracks in the snow that he had a very extended takeoff roll, in fact rolled virtually the full length of the runway. He struck several hard lumps of packed snow/ice with nose and main wheels, which probably slowed him down. When he lifted off he did not climb enough and flew into the tops of some small trees of the end of the runway. The left canard and left elevator were torn off at this point, which caused the airplane to roll left. The left wing then struck the ground and was broken off at BL57. The airplane rolled inverted and crashed into a frozen swamp on the edge of the lake. It then slid over a small embankment and broke through the ice coming to rest in four feet of water. The fuselage remained essentially intact, however the pilot was killed instantly.

The cause of this accident appears to be a combination of several things. 1) Takeoff attempt on an uncleared runway with snow and lumps of ice. 2) Frosted canopy probably restricting visibility. 3) Total darkness with lake at end of runway resulting in "black hole" visibility effect at lift off, causing disorientation. As is often the case in accidents, one problem could probably be handled by an experienced pilot, but a combination of the right conditions can be enough to result in disaster.

Composite Structure Fire - There were no instances of fire on any VariEze type structure in over 200,000 flight hours of operation - until last fall. Here's the report from Ron Walter:

"I pulled in front of my hangar, shut down the engine and put the plane on its nose. Looking back I noticed flames coming out the back and proceeded to get an extinguisher to control the flame. This was to no avail and resulted in completely destroying the plane within approximately 12 (more) minutes."

A fellow VariEze builder arrived on the scene after the entire engine area and cowl were involved and he offered the following, cautioning that some is conjecture.

"At runup area engine did not sound normal. After several tries at runup he taxied back to hangar parking. Time of run was about seven minutes. On shutting down the engine with the idle cut off he noted smoke from engine compartment. He retracted the nose gear, got a small fire extinguisher and emptied it into the fire. By that time however the fire was out of control."

"Fire definitely was well along in the engine compartment when aircraft was shut down. It might have been arrested if fuel valve had been closed when smoke was detected and fuel burned through engine. Initial cause was stuck float in carburetor which kept feeding fuel to point of overflow (conjecture)."

"The aircraft was headed west and wind was from 240 degrees about 3-5 knots. This fact inhibited the fire somewhat but I was surprised at the slow propagation of the fire, about 2 to 3 inches per minute forward on both wings. The heat softened the upper wing strake to the point that when the gas in the tanks ignited there was only a large "poof" - no contained explosion or any shattering. Even at this point neither the outer wing spars nor the center section box, showed deformation. Obviously they were getting soft but no sag. Within the next minute the fuel from the tanks intensified the fire to where everything melted down and completed burning forward to the front cockpit. At this point the main gear softened and gave up. Fire truck arrived and put out remaining fire.

Findings: Carburetor completely melted down to point of distortion - recognizable, but that's about all. Fire wall took a lot of heat before allowing fire to progress forward. Fuselage tank failed through sight gauge first. I could not tell whether the fuel feed line from the tank to the shut off valve had softened and burned feeding the fire. Engine mount distorted but intact. Top of wing tanks burned but bottom remained intact until almost complete collapse of main gear."

Ron also shared with us a poem written after the fire by his wife.
"You were the diversion he needed in times of stress.
You were solace to him when he was not at his best.
When the world was to much for him to cope,
He turned to you, and you gave him hope.
In the wee small hours when sleep wouldn't come,
You were there - always something to be done.
You and he saw the world from a different view,
When you soared together to the distant blue.
You're gone now - no more obsession.
Only memories left - the only possession.
You were the joy and the pride of his life.

I can't fill the void. I'm only his wife".

VARIVIGGEN NEWS
Bertil Fornen, from Stockholm, Sweden sent in a few photos of his Viggen project and it really is going to be something. Bertil has installed a full IFR panel, has a neat electric reflex, and has completed the installation of the main gear retract system, which is the same as that on N27MS. His nose gear retract mechanism uses a slick little motor driving the gear up and down through a toothed belt. Looks like an excellent idea - let us know how this works out, Bertil.

George Craig called on us here at RAF last week and showed me some photos of his excellent Viggen, which is coming along well. George finally got his main gear operating and is very satisfied with it. George had problems getting the correct springs to help pull up the gear and tells me that anyone wanting a set of springs to do this job should order them from:
Stock Springs Co., (415) 828-0373
Talk to Truman Allen. You will need 8 springs (4 on each side) .062 wire dia., 302 type stainless, 1/2" OD x 11 5/8" free length. George paid about $35 for all 8 and reports that they work great.

Arthur Schwartz reports that his Viggen is running like a dream and he now has 123 hours on the tach. Arthur is planning on installing the worm gear main gear system soon, up till now he has been flying with the main gear down and nose gear retracted. The cable system is just too unreliable. Reference CP 26, page 9, when Arthur's Viggen had the right main collapse while taxiing. There is a lesson here, to my knowledge there has not been a single Viggen that has had a satisfactory main gear using cables or chains. Every one to date has had one or more failures. The worm drive system as used on N27MS has been 100% successful so far, and it is now the standard recommended system.

I have not had a written report from Len Dobson, but he called a few weeks ago with the heart breaking news that he had collapsed the gear on his ship. Briefly, he landed on a narrow runway, with a strong cross wind, and drifted off into soft sand or mud, this tore off the nose gear and folded up one or both mains. Damage to the airframe is fairly extensive, but Len is unhurt (physically). He plans on rebuilding and will keep us posted.

FROM THE BUILDERS

Dear Burt, Dick, Mike and Sally,
We can't thank all of you enough for your generous support and help in our flight test of our Long-EZ N7LZ. We (son Dean, wife Joan and I) worked on this project for slightly under one year and we couldn't be more pleased with the resulting product. The Long is fully equipped with R-NAV and transponder for easy cross-country cruising; and, with Burt's unique design, it performs like no other two place aircraft for this purpose. It weighed in at 874 lbs. without wheel pants or spinner and apparently is the 12th Long-EZ to fly. Mike's gracious offering to fly the first flight was more than we could expect, but he went further

and checked out Dean. Since I'm only a student pilot, Dick, who is a CFI, checked me out. Burt personally inspected the craft and pronounced that it would fly straight and true and it did! The required 25 hours of test flying was completed within 5 days, so we were on our way home only a week after we arrived. The only problem encountered was a need to correct a slight cusp on the aft edge of the elevators and rebalancing them. Performance matched or slightly exceeded the owners manual values.
Thanks again,
Bob, Joan, and Dean Hansen.

Dear Burt,
VariEze N774 lifted off at Tehachapi airport on November 12, 1981. The duration of the flight was for 35 minutes and everything went well. I had two rides previously in VariEzes, one with Bruce Tifft and another with Richard Clark, so the feel and performance was about what I expected. At completion it weighed in at 638 lb. It has a C-85 without starter, standard instrumentation and a B & T prop. At 7000 ft. 2650 rpm it indicated 152 mph. It flies straight and level, hands off and stalls at 65 mph with no tendency to drop a wing. From the moment I saw N4EZ about four years ago I wanted to build this airplane and to say that I am pleased and proud of this little bird is an understatement. The highest tribute that I can pay to your expertise and builder backup is to say that after 46 years of active flying, 37.5 with TWA, it was one of the highlights of my career to fly my own personally constructed aircraft. I want to thank you, Mike Melvill and your entire crew for their patient help and encouragement which allowed me to enjoy this experience.
Sincerely, Bob Cummings, Tehachapi, CA

EZ Autumn Escapade - by Bruce and Bonnie Tifft.

Flying U.S.A. during the autumn season is truly spectacular, as we discovered for ourselves on our recent almost 7000 mile trip across our glorious country. Fantastic, beautiful, breath-taking, magnificent, etc... etc..., were the only words we "almost native" Californians could find to describe the awesome spectacle of the colorful trees, shrubs, flowers and scenery as we visited the various states on our journey to and through New England. Someone up there was really looking after us as far as the weather was concerned because we found ourselves in crisp, clear, sunshiny blue skies almost all of the trip; only a few days of scud-running out of the three weeks we were gallivanting around the country. Not only were we delighted with the beauty of these United States at this particular time of the year, but of the marvelous assortment of friends, new and old (not age-wise of course), that we met along the way. We almost wore out our Hospitality Club list from using it so much. It was easy calling on the members that we had met previously at various flyins since we felt we knew them already, but it was a little more difficult to call up "strangers". However, what we found very quickly was that none of us that have these super flying machines, or are in the process of building them, are strangers. We were welcomed in each and every instance like long-lost friends or relatives. There is a tremendous, warm bond between the people with these airplanes, and we thoroughly enjoyed our stay with each and every one of the Hospitality Club members and also our B & T customers that we visited. It was great for us to have the opportunity to get acquainted with all these interesting people, and they seemed to

enjoy the chance to swap EZ stories, get building hints, chat about the flyins, etc. Of course, back-seat checkout rides were a must for all the would be EZ pilots and it was such fun to see the reaction from the fellas and gals who have never had the thrill of flying in a EZ before. They were so excited and enthusiastic about the wonderful flying characteristics of the EZ. It's especially fun to get this reaction from the high-time pilots who have flown lots and lots of different kinds of aircraft over a period of many hears. They are as impressed as the brand new pilot. It's really rewarding for us to share this experience. Our journey took us up to Salt Lake City, UT; over the wilds of Wyoming (where we had the opportunity to check out how service roads compare with runways - however, that is another looong story what we will share some other time); into the Plain states and a stop in Lincoln, NB; up into Minneapolis/St. Paul, MN; around Lake Michigan to Lansing; over across Canada and Niagara Falls to Utica, NY; down to Hyannis, MA and Cape Cod Bay where we had our only "crash" for the trip - Bonnie falling off her bicycle on Nantucket Island; up to Camden ME; (missed our visit to Vermont since weather was reporting two inches of snow - burrr); down the southern route and stop in Bruce's hometown of Allentown; PA; on down into Illinois, Missouri, Oklahoma and into Texas, New Mexico, Arizona and back again to California, with a stop at Mojave to relate our adventures to the RAF crowd. We arrived home with six rolls of slides and an enormous collection of memories to hold us for at least another year (well, maybe six months). We have found that these EZ adventures are becoming habit forming and eagerly look forward to planning and experiencing the next one. Our sincere thanks to Shirl and Diana Dickey, Jo and Carlye Reinmuth, Nat and Shirley Puffer, Buzz and Ann Weatherly, John and Fran Kevern, Gary Price, Joe and Fran MacDonald, and Harris and Cleta Sue Howard for their warm, friendly hospitality. As Harris and Cleta would say "Y'all come visit us sometime".

NOTE FROM B AND T PROPS
Bruce recently retooled his prop drilling jigs and asked us to inform anyone with a B & T prop, shipped prior to January 1, 1982, if you are checking balance, to use only the 2 1/4" dia. hole, do not use the 3/4" through hole, since it may not be concentric. Props shipped after the above date, you can use either the 2 1/4" dia. hole, or the 3/4" dia. hole or both to balance the prop. Please don't hesitate to contact Bruce or Bonnie if you have any questions at all concerning your prop. 805-649-2721

SHOPPING
Task Research - Fuel/baggage strakes are in stock for immediate shipment. Special on the next 25 orders only. Ribs and baffles will be included with strakes for $884.

John Frilling, who sells a set of plans to make a light weight alternator, as reported in CP 26 page 11, has recently moved. John's new address is:

John Frilling,
743 Annoreno Road,
Addison, IL 60101

Find that elusive CP article! Index for Canard Pushers #16 through #29 now available. $3.00 per set, 10 pages.
Bob Coon,
26 Cloverdale Street,
Pittsfield, MA 01201

For Sale: VariEze prefab parts.
Brian Roach,
1238 West Street,
Woodland, CA 95695
916-622-2912

For Sale: VariEze original main and nose gear struts and other prefab parts.
Grover Smith,
509 Valley Vista Drive,
Benton, Ark 72015

For Sale or Trade: Original VariEze nose and main gear - needs Long-EZ gear.
Gail Jergensen,
2725 Comanche Drive,
Salt Lake City, UT 84108
801-583-2725

Wanted: Prefab wing/fuel strakes for VariEze
Tom Tyner,
P.O. Box 11625,
Houston, TX 77293
Home 713-358-6816
Work 713-695-9262

For Sale: Original VariEze exhaust systems, these need a slight modification - for Cont. O-200 limited quantity - $50 a set.
Ken Brock Mfg.
11852 Western Ave,
Stanton, CA 90680
714-898-4366

For Sale: C-85-12 tapered shaft, 1350 hours total time on case. 0SMOH logs and related documents. $2600 firm (plus shipping).
Steve Franseen
1245 S. Tennyson
Denver, CO 80219
303-922-6081 (evenings)

For Sale: O-200 Cont. 0-SMOH, $2200 cash, Less oil tank and magnetos.
Doug Klever,
2820 Prince Road,
Crescent City, CA 95531
Home 707-464-9829
Work 707-464-2656

For Sale: 8 Lycoming O-235-L2C engines. Zero time per specs for Long-EZ. With Lycoming warranty. $6695 outright, freight paid inside the USA.
Memphis Aircraft Power Service,

P.O. Box 38304
Germantown, TN 38138
901-754-0214

HOT WIRE SET UP - The homebuilt hot wire set up that was described in CP 29, page 8, works fine, but many have had problems locating the parts. Vince Golden has kindly agreed to provide the transformers for those who can not locate them locally. Contact Vince at: Mike Quinn Electronics,
Bldg. 727 Langley Street,
Oakland Airport, CA 94614
415-569-1539
Vince will send you the transformers and modification parts by UPS for $7.50 plus $3.50 shipping.

Rusty Foster has developed a very nice space saver console that fits on the right side above the stick. This prefab panel will fit into a VariEze or Long-EZ. See photos. This looks like an excellent idea, is light weight, and a practical method of getting more room on your instrument panel for avionics/instruments.
Contact: Rusty Foster
P.O. Box 4273
Ventura, CA 93004

Due to some confusion over AN versus MS hardware, we have complied a conversion chart which should help clarify things. Our thanks to Bud Meyer of Wicks Aircraft for assistance in getting this chart together.

AN509------MS24694	AN819------MS20819
AN364------MS20364	AN822------MS20822
AN365------MS20365	AN823------MS20823
K1000------MS21047	AN500------MS35265
AN380------MS24665	AN936------MS35333
AN393------MS20392	AN931------MS35489

Solid aluminum rivets:
AN_ _ _AD_ _=MS20_ _ _AD_ _

This layout (from Section IIL, page 36) shows the aluminum to steel fitting changes - circled items: **SKETCH OMITTED**

CP31, Page 8

A Chino Valley area Long-EZ club for beginners, those in the middle and those finished. Let's get together and share some of our ideas and helpful ideas and helpful hints.
For more information please contact:
Kim Prout, 3801 Carlos Court, Chino, CA 91710 (714)628-1403
or Paul Prout (714)621-0060
Everyone welcome.

Our thanks to Gerry Grueber for sending in these nice photos showing the fuel/baggage strake construction.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Jig "tables" in place ready to build bottoms of fuel/baggage strakes on a Long-EZ.

Fuel/baggage strakes with bottoms layed up and ribs micro'ed into place. Be sure to do almost "wet" layups inside your tanks to eliminate the chance of leaks later on.

Ribs, layed up, will be knife trimmed later. The notched out openings should be painted with pure epoxy. No need to do a glass layup on the edges of any of these holes.

View of the inside of the top of the fuel/baggage strake. Note that this foam part is supported by a lumber frame bondo'd to the outside.

Fuel/baggage strakes floxed into place for cure.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Size comparison 3.40 x 5 - 4 ply and the new 11 x 4.00 x 5 - 6 ply. The new 11 x 4.00 x 5 - 6 ply has shown excellent durability in service. We strongly recommend it or the 500-5 for the heavier Long-EZ. Also, it is the best VariEze tire size.

These are the new RAF jacket patches - the general logo on the top and small Long-EZ on the bottom. We also have VariViggen and VariEze bottom patches. See page 1 for prices.

Grizzly, Model 77, on her first flight, with Mike Melvill at the controls. Polaroid photo by Pat Storch snapped just before this newsletter went to press. The Grizz matched the stability predictions and has exceeded performance estimations.

This photo clearly shows the 7 to 8 degree camber of the Long's gear with a light load.

OK, which way to a runway! Roger Johnson's Long nearly complete.

First-released photo of our Model 77 Solitaire self-launching sailplane. The fuselage shells were lofted and plotted on our Apple II micro computer with lines optimized for the thermaling design point. The engine is in the nose, with the prop extending out of the forward fuselage.

Rusty Foster's space saver side panel for Long-EZ. See page 8.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.

Empty Basic	710 lb.
Empty Equipped	750 lb.
Solo Weight	960 lb
Gross Weight	1325 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	550/830 ft
Climb (solo/gross)	1750/1350 fpm
Cruise 75% 8000 ft	183 mph
Cruise 40% 12000 ft	144 mph
Max range * 75% (solo/2 place)	1370/965 mi
Max range * 40% (solo/2 place)	2010/1430 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200
SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx	6.75	8.75

10,000 words per issue.		
Long-EZ plans. Section I	198.50	212.50
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order.		
Newsletter not taxable.		
TOTAL		

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $3

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $3

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Sally Melvill taxiing out for first Long-EZ solo flight.

Long-EZ parked nose-down with two VariEzes.

The nose gear retracts for parking and in flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Model 72 Grizzly during recent rollout, surrounded by VariViggen, Long-EZs, Defiant and Amsoil Racer.

THE CANARD PUSHER NO 32 Apr 82

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 32. If you are building from 2nd Edition plans you must have newsletters 18 through 32. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 32. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 32.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 on Saturday. Closed Sunday. If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

Saturday Demos. - Every Saturday (except when gone to airshows) RAF conducts a demo at our shop at the Mojave Airport. We start the presentation/discussion at 10:00am each Saturday with flight demos of our experimental aircraft at approximately noon (weather permitting).

RAF Activity
Since CP 31 has involved development of structure, controls, landing gear, and propulsion system for our self-launch sailplane, the Solitaire. In addition, our Grizzly research STOL aircraft has completed it's basic land-plane flight test development effort. Due to a higher priority on the Solitaire and to some consulting commitments we are not pursuing the Grizzly amphibious floats at this time. We may begin that this fall.

The Solitaire development was delayed by propulsion system problems, however a redesigned configuration is now running smoothly in our test stand and we expect to be into flight testing by mid May.

RAF has made a "few" covers of magazines since the beginning of '82. The following is a list. The first three are photos taken by our own RAF photographer, Pat Storch.

Popular Science - May
Homebuilt Aircraft - April
Aviation Week and Space Technology - January 25
AOPA Pilot - April
Plane and Pilot - April
Private Pilot - April
Homebuilt Aircraft - May

SEMINAR IN FLORIDA
In February Burt and I flew to Miami, Florida (in a Lockheed L-1011) where Burt was the speaker at EAA Chapter 37's annual banquet. I was lucky enough to tag along, and I must say I really enjoyed the banquet. The food was good, Burt's talk and slide show, as always, was great and being in the company of so many VariEze and Long-EZ builders and flyers was neat. Charlie Gray, a Long-EZ builder organized the whole affair, and did a super job. A really nice touch was that each person at the banquet received a water glass, with a Long-EZ printed on one side and the Chapter logo and date printed on the other.

The next morning Saturday, Charlie drove us to the Fort Lauderdale Executive Airport, where Burt and I gave a composite seminar to about 300 people. At least two Long-EZs and two VariEzes flew in and I was pleased to be invited to fly Jack Fehlings gorgeous VariEze "Yellowbird". Burt and I spent a couple of hours talking to builders, before the seminar, and several things were noted on both Long-EZs that were there. Smooth contour on wings, canards and winglets is really important if you are to get the performance you expect. Paint stripes along the leading edges of wings and canards are only acceptable if there is no masking tape joggle. A joggle like this can trip the boundary layer and transition good, low drag, laminar flow into high drag, turbulent flow. NASA tests on our Long-EZ has shown that destroying all the laminar flow can cost you up to 11 knots!

Prior to the seminar, Charlie Gray had got hold of a reject canard that we looked at and Burt agreed that it should not be installed on an airplane. We decided to do an informal static load test to destruction. So we called for people weighing about 175 lb. With Burt positioning each person for correct load distribution, we proceeded to try to fail the canard. We got 18 people (not an easy task, very little room!) on it before we finally got a few minor cracks. At this point, Burt calculated we had 11.54 g's on it, and it still would have got the airplane home. It did not fail catastrophically. Someone must have photos of the 18 people on it. We didn't get one, unfortunately.

The seminar went well, we both enjoyed the opportunity to answer questions, look at parts, and do some hands on, hot wire cutting, layups etc. When we went back to Charlie Gray's home, both of us were a little "hoarse" but it was fun. Sunday, on the way to the airport, we visited a couple of Long-EZ projects, wish we could have seen more

of them. There are a lot of Long-EZs under construction in the south of Florida. Thanks to Charlie and his wife Betty for showing us such fine hospitality. Charlie should be flying his Long before to long.

SCALED COMPOSITES, INC.: HELP PART II
Many thanks to the people who have submitted resumes in response to the ad in CP 31. The response was more than we expected. We haven't yet selected people for the positions offered but will have made the selections by mid to late summer for hiring in September. All those who wrote to us will be contacted, so please be patient with us. SCALED has purchased a new Computer Assisted Drafting package and we are looking for an enthusiastic engineer/draftsman to use it. The system is based on the Apple II + microcomputer and runs in PASCAL, so some experience there would be helpful. We also need a bookkeeper/accountant (any MBA dropouts out there?). The receptionist/executive secretary position is still open for the right person, the French speaking requirement is no longer necessary but the word processing experience is.

NEW RAF POSTER NOW AVAILABLE. SEE BACK COVER

MIKE & SALLY'S LONG-EZ
N26MS has been spending more time in the hanger than usual due to bad weather, while the weather in Mojave is almost always acceptable it certainly is not in Tehachapi, so during the two to three months of winter type weather, we have been driving, and what a pain that is! On top of that it actually takes more fuel to drive our Honda Accord to work and back, than it does to fly the Long!

Even so we have managed to put some time on her, she is just over one year old and has 320 hours total time. I did an annual inspection last month and found very little, I adjusted the rudder travel, relined the brake shoes, changed the oil, topped off the batteries, checked brake fluid level and that was about it. Engine health is excellent with compression like new on all four cylinders.

The airplane has proved to be exactly what I had hoped, a low maintenance, high utility, high speed, economical cross country airplane. I have been testing a small electric cabin heater for the past month or so. This heater is STC'd for any aircraft, and came to me from Steve Franseen, 1245 S. Tennyson, Denver, CO 80219. Steve is a Long-EZ builder and is the distributor for the heater. Contact Steve if you are interested.

The heater I have is a 12v 16 amp heater, with an advertised capability of heating a 50 cubic foot area. On the ground, static it is much more that you need. In the air at a normal cruise speed around 160 knots true, in my Long-EZ, it is marginal with an outside temperature of -14 C. This is primarily due to the many air leaks that I have, around the elevator tubes, the nose access hatch, etc. I am sure that with close attention to sealing the nose of your Long-EZ from all leaks, this little heater will do an adequate job. I am going to be testing a 24v 16 amp heater, which has an advertised capacity of 80 cubic feet, in

the next few weeks and will report on the performance in the next CP. The heater is well made, has a built in fan and safety cut out. It is also internally fused. It completely eliminates the problem of carbon monoxide contamination, and is easy to hook up. I installed mine in less than an hour.

I have also recently installed a Compucruise and flo-scan fuel flow transducer. I elected to use a flow-scan series 100-A, which has a range from 1.5 gph to 15 gph. It is a real kick to fly with this gadget on board, as you can really keep track of your fuel management. Once calibrated, it is accurate, and measures fuel burn in 1/100ths of a gallon. The only apparent drawback I have found is that the Compucruise, even with the display turned off, will drain a 12 volt 25 amp hour battery in less than two weeks. This is no problem as long as you use the airplane at least once a week. But I would recommend a master switch to shut the Compucruise down completely if you don't intend flying for extended periods. This of course drops out the memory and your fuel flow calibration, but it is not difficult to reenter.

We have entered our Long-EZ in the Cafe 400 race, and are looking forward to it. We expect to be quite competitive, with the race being extended to about 400 miles from 240, and a requirement to climb from sea level to 10,400 feet and back. What with the Long-EZ's high aspect ratio and low induced drag, we should make a good showing.

Sally recently had a "#99's" meeting at the Bullhead City Airport, on the banks of the Colorado. This is a nice little cross country of about 190 nautical miles each way. We gassed up both the Long-EZ and the VariViggen. Son Keith went in the back of the Long with Sally and I flew solo in the Viggen. A beautiful day, with a 26 knot tail wind took us there at 7,500 feet indicating 120 knots with an average ground speed of 162 knots (187 mph). The return trip against a 26 knot head wind found us flying low, from 100 feet to 500 feet AGL. Crossing the desert at low altitude at 140 knots indicated is really fun, but in the Viggen it really burns up a lot of fuel. Which meant we had to land at Barstow-Dagget for gas. A quick low altitude dash from Barstow to Mojave and I tallied up the fuel burned in each airplane for comparison. While the Viggen with its 180 hp Lycoming, used 24.7 gallons, the Long with its 118 Lycoming, used exactly 12 gallons and carried two people. This is a good comparison showing the difference between a low aspect ratio (requiring lots of horsepower) VariViggen and a high aspect ratio, low induced drag (requiring very little horsepower) Long-EZ, both flying at the same speed and altitude, the Viggen averaged 8.8 gph, while the Long averaged 4.4 gph.

EZ-CALC?? FUEL FLOW INDICATORS

The EZ-Calc system as discussed in several previous newsletters, has apparently been dropped and will not be available. A lot of builders have seen the Zemco Compucruise, an automotive driving computer, in the prototype Long-EZ and as a result, several VariEzes and Long-EZs have these installed. RAF has never come out and recommended this installation however, since we were and still are very concerned with the fuel flow transducer that comes with the Compucruise. This transducer has a tiny passage way for the fuel, and it would take only a minute piece of foam or other contaminate to shut off ALL fuel to the engine. This is not at all acceptable and any EZ pilot currently using

this set up should ground his airplane until it has been changed. Also, the pressure drop is too great for a gravity system.

Byron McKean of Seguin, Texas, has done a lot of development work with the Compucruise and he has come up with a system that works great. I have one in my Long-EZ (N26MS) and am very satisfied with it. What it consists of is the basic Zemco Compucruise computer, but the transducer is discarded and an aircraft-type flow transducer, made by Flo-Scan, Seattle, Washington is substituted. Byron has also devised a neat little gadget he calls a 'Gizmo', that you can readily build yourself with parts from Radio Shack. This enables you to dial in your ground speed, and then you can get all of the functions out of the Compucruise. In effect this gives you a poor mans DME, with accurate fuel management information. I installed mine in my Long, in two pieces. I literally cut the Compucruise in half and remote wired it so that the keyboard is flush mounted into the right console just aft of the stick, and the display is mounted up at the top of my instrument panel. This was not difficult to do and it looks and works great. I have continuous information regarding fuel flow, in GPH, as well as fuel used and fuel remaining. I also have battery condition (voltmeter), inside and outside air temperature, a count up timer, and trip timer, and with ground speed and trip distance 'inputted', time to arrival, time to fuel exhaustion, etc. etc. On top of that it has an accurate digital clock. I am delighted with mine and would recommend anyone who is interested in a fuel flow indicator to go with this system.

Contact: Byron McKean
Rt 1, Box 429-B
McQueeney, TX 78123
(512)557-6575

For $12.00 Byron will send you a very complete letter with wiring diagrams, sources for parts, part numbers, prices, literally everything you need to know to do the installation. We must stipulate that we recommend this installation ONLY if you use the Flo-Scan fuel transducer. Do not use the Compucruise transducer.

SUN 'N FUN FLYIN 1982

Irene and George Rutan (Burt's Mom and Dad) again made the trip east and did an excellent job representing RAF. Irene managed again to get all the EZ pilots names and aircraft numbers. Everyone who went to Sun 'N Fun agreed that it was one of the nicest airshows ever.

RAF type airplanes were very well represented, and by the end of the week, Irene had logged in 28 VariEzes and 5 Long-EZs. She reported that they had a ball, chatted with all the pilots, and also managed a ride in the Dragonfly!!

Dick and Jeana flew out in their Long-EZ (modified) and Dick did a super job of putting on evening airshows.

The now traditional race that Dick started three years ago, was held again. Steve Woods did the officiating and 8 airplanes entered. It is

interesting to note that a standard 0-235 powered Long-EZ won, after handicap correction. He was only 7.4 slower than the fastest VariEze.

We would like to thank all the people that did such good work for RAF. Johnny Murphy, who put on a excellent forum, Dick and Jeana for helping Johnny and Dick for his airshows. Steve Woods for organizing the race, and, of course, our special lady, Mom Rutan for her tireless work on the flight line.

RAF Aircraft at the 1982 Sun 'N Fun Flyin.

Long-EZs		
N169SH	Dick and Jeana	CA
N21VE	Johnny Murphy	FL
N506EZ	Dr. Sparkman	FL
N141NH	Neil Hunter	FL
N81HM	Herb Sanders	TN
VariEzes		
N29T	Stewart Shannon	IL
N778CB	Curtis Berry	TN
N55EF	Howard Thompson	AL
N64592	Bruce Evans	CA
N77ODY	Don Yokam	FL
N75EZ	Jack Sargent	FL
N115AM	Sam Cachran	FL
N25RR	Robert Ridihalgh	IO
N15RL	Roger Longsway	FL
N111DR	Don Riley	
N711VE	Steve Alexander	IN
N86DH	David Hersterlee	GA
N301RW	Robert Woodall	MD
N91CL	C. Langerud	TX
N444EZ	Jack Fehling	FL
N2286A	H. Ferguson	NC
N40EZ	John Benjamin	PA
N80SH	Seth Hancock	
N36SD	S. Darlington	IN
N14KM	Kurt Duncan	FL
N82JF	John Fowler	IO
N25RH	Rick Himerick	TX
N83DL	David Langston	GA
N80EK	Elvin Kime	MO
N8493W		
N810TC	M. Pavlovich	WI
N56EZ	Steve Woods	FL
N2UM	Paul Mason	FL

Results Of The 1982 Sun 'N Fun Race

1.	Paul Mason	186.4 mph	0-235 Lycoming	VariEze
2.	Herb Sanders	184.4 mph	0-320 Lycoming	Long-EZ
3.	Jack Fehling	182.4 mph	0-200 Continental	VariEze
4.	Bruce Evans	181.0 mph	0-200 Continental	VariEze
5.	Neil Hunter	179.0 mph	0-235 Lycoming	Long-EZ
6.	Bob Woodall	169.6 mph	0-200 Continental	VariEze
7.	Rick Himerick	168.0 mph	0-200 Continental	VariEze

8. Don Riley 152.0 mph 0-200 Continental VariEze

Handicap Results
(Planes were handicapped for engine size, wheel pants, etc.)

1. Neil Hunter 184.0
2. Jack Fehling 179.4
3. Bruce Evans 178.0
4. Paul Mason 176.4
5. Herb Sanders 170.4
6. Bob Woodall 169.8
7. Rick Himerick 168.0
8. Don Riley 152.0

VARIEZE HOSPITALITY CLUB
Seven VariEzes, Kappermans, Hamlins, Wilsons, Days, Moores, Lees, and the McFersons got together at Imperial in Southern California, they then flew south across the Mexican border to Mexicali, where they cleared customs with no problems, filed flight plans, ($4.00 each) and flew en mass down the east coast of the Baja peninsula to Loreto. Four fantastic days were enjoyed by all. One day they all flew on south around the tip (Cabo San Lucas) and up the west coast to the whale breeding area, then turned east, stopping at La Paz, and then back to Loreto. The only incident was Alan McFerson blowing a main tire, no problem though, Ron Kapperman had a spare! The flight north to Mexicali was smooth and uneventful. From Mexicali to Calexico (to clear U.S. customs) had 5 VariEzes on final, when someone at Calexico suddenly noticed them and came on the unicom frequency "caution Calexico traffic, bunches of VariEzes in the pattern, they're thicker than flies!". A great trip with perfect weather, as Ron Kapperman put it, "It could not have been any better".

EZE FLY-DRIVE-IN GET TOGETHER
April 24th 10:00 am to 4"00 pm.
Place - Brookenridge Air park. (Southwest of Chicago),
960 86th Street, Downers Grove, IL 60516.
21 DME miles out on 050 radial Joliet VOR.
27 DME miles out on 305 radial Chicago Hts VOR.
West end of runway 9-27, 2800 feet, MONITOR 122.9.

Activities - Weather permitting - Picnic or hanger flying. Hosts will provide soda, bratwurst, buns for $1.50 per person to cover costs. Bring pictures, parts, anything of interest. PLEASE tell us if you are coming. 312-985-6671. Bring a salad or desert if possible.

Note - This is a private strip that is sensitive to the concerns of non-aviation neighbors so please use standard left hand pattern at 1500 msl. NO buzzing or touch and goes. No fuel. Our parking is limited, lets' limit the fly in to EZ's only if possible.

Bring any ideas for other activities in the future, bring family.
Hosts - Talbors, Steichens and Gutches.

CLUBS
A Long-EZ club has been formed in the Chino, CA area. With 26 members already, this is a fast growing club. For more information contact: Dick Kreidel

4422 Acorn Street
Yorba Linda, CA 92686

SAFE-T-POXY REACTIONS
In CP 31, we asked for reports from anyone who has experienced a reaction while using the SAFE-T-POXY. To date (April 4) we have received 47 letters, all of which have been sent onto Applied Plastics, the manufacturer.

It is still difficult for us to access the extent of the epoxy sensitization. Less than 3% of the builders sent reports of problems, but we must assume that many of you did not bother to write. Applied Plastics are presently reviewing your reports and investigating the problem. They recently sent in a random SAFE-T-POXY sample for testing and it again came back a zero on the SPI scale from zero through 10. For perspective, a common industrial epoxy. 815 has an SPI 6, while RAE epoxy has an SPI 3. SAFE-T-POXY is an SPI 0.

Applied Plastics is developing a very through pamphlet covering the use of SAFE-T-POXY and precautions to take to avoid the reaction in the first place. They also have suggestions to help you get around the problem. If you are having a slight reaction and are using SAFE-T-POXY, be absolutely certain that you do NOT have MEK or acetone or lacquer thinner in the shop at all. Just breathing the fumes of these solvents can render you vulnerable to the epoxy. Getting these solvents on your skin is asking for trouble. If you are using gloves (NEVER use Ply 9 and gloves together, it is either gloves or Ply 9) try using different types of gloves, even surgeons have allergic reactions to some gloves. Try using thin cotton liners under your gloves, this soaks up sweat, and will show you if you get a break or tear in the glove. While sweating you can sometimes be more vulnerable to allergies. A method that has worked well for some builders is to use only Ply 9, and to stop at least every two hours, wash your hands and arms thoroughly with a good borax soap (Lava) paying particular attention to scrubbing under finger nails and around your cuticles. Dry your hands, reapply Ply 9 and return to the layup. Do not exceed the two hour period. Wash up as often as necessary during a long layup. If your sensitivity to breathing the fumes is severe, full-face respirator can provide a solution. (W. W. Grainger #5X803 is an example).

To summarize, cleanliness is the 'biggy'. Do not allow epoxy, solvents or any industrial type materials, to come in contact with your skin, not ever. Wash thoroughly, often. Use a good respirator and/or ensure that you have adequate ventilation. If you still have problems you might consider switching to the RAE epoxy system. This may sound silly, (an SPI 0 to an SPI 3), but the fact is you may be reacting to a particular chemical in SAFE-T-POXY, that may not be in the RAE system. This has worked for several builders. The allergic reaction healed and they were not bothered again. Beware though, RAE is definitely more toxic. Take all possible precautions when using either of these systems. Finally, if you still have problems, let us know so that we can keep giving the manufacturer this data. Plastics good feed back.

LYCOMING 0-235 ENGINE INSTALLATION
If you bought a new engine from Avco Lycoming and specified it for a Long-EZ, your engine should be set up correctly for an oil cooler and a standard oil screen housing, not a full flow oil filter, which will not fit.

Those builders who purchase a used engine should check the following items: If you have a full flow spin on oil filter, it must be removed, so must the AC adapter that is bolted to the accessory case. There is a thin aluminum plate between the AC adapter and the accessory case, this must also be removed.

Now you need to purchase a standard oil pressure screen housing, Lycoming Part #68974, and oil screen, Lycoming Part #62817, and a gasket for the screen housing, Lycoming Part #61173.

The assembly should be bolted to the accessory case, and your oil temperature probe installed in the tapped hole in the aft end of the screen housing. If you install an oil cooler, you will also need to purchase a spring, Lycoming Part #69436, a plunger, Lycoming Part #62415, and a gasket Lycoming Part #STD-294. The plunger and spring should be installed under the large plug screwed into the top left of the accessory case. Not all accessory housings have this port. However if housing is machined for cooler it is provided. The plunger and spring are required if you have a standard oil screen and housing and an oil cooler. The plunger regulates oil to the cooler (oil cooler bypass).

There is another option available and it is an oil screen housing with a thermal valve assembly port built into it, together with a tapped hole for your oil temperature probe. This housing is Lycoming Part #69510, screen is Lycoming Part #62817, and thermal valve assembly is Lycoming Part # 75944.

If you choose to use this screen and housing you must not install the plunger and spring (#62415 and #69436). This is a situation with either one system, or the other, never both. If you choose not to install an oil cooler, you need only to install the standard oil screen and housing (#62817 and #68974). You should install the plunger and spring, or the thermal valve assembly and housing. However, your oil temperature will run hot, close to or at the red line, which means excessive wear in your engine.

0-235 L2C Engines From Cessnas 152s These engines do not have provision for a mechanical fuel pump. The fuel pump is mandatory for a Long-EZ, so you either have to get your accessory case machined (Avco Lycoming will do it and so will Air Engines, Florida) or buy an accessory case from any 0-235 that is already machined. Be careful about using an accessory case off an 0-320 or 0-360. While these parts will bolt on perfectly, they may not have the correct oil ways machined into them to lubricate the idler shafts. Again Air Engines, Florida can do this for you. You will also require a timing gear with the cam lobe on it and a pushrod.

BENDIX MAGNETOS IN A LONG-EZ?
This question comes up more and more in spite of the subject being covered in Section IIL, Page 3. The fact is that we tried to install

Bendix mags on a Long-EZ and there was an interference between the left mag (right of airplane) and the aluminum extruded angle on the right side. This interference occurs right in the area required for timing adjustment, so we called out only Slick mags. Slick mags are smaller and much lighter and in our opinion and experience every bit as reliable, particularly the newer rebuildable Slicks. We do admit though that we never really researched into the problem, possibly there might be a relatively simple fix that would allow the use of the Bendix mags, anyone who has seriously addressed and solved this problem should let us know. We do not want to get into any changes to the engine, adapter plates etc., since engine reliability is of paramount importance, and we can not recommend a change that may hurt reliability.

CP32, Page 4

CAUTION
Spinner/prop extension compatibility. This is a real gotcha! We installed a new prop extension on N79RA, which was not manufactured by Brock. We then installed a Brock spinner on this extension. The center hole in the spinner backplate was a close fit on the center locator on the prop extension. Unlike a Brock prop extension, this one had a rather large radius machined at the flange face, which did not allow the spinner backplate to slide all the way on, see sketch below.
SKETCH OMITTED

This is a dangerous situation, and difficult to detect because the flow guide prevents a visual inspection. We installed the prop, torqued the bolts to the 18-20 ft/lbs. we normally use, and tracked the prop tips accurately. At this point, the prop bolts were tight, the prop ran true, but the prop was not being squeezed against the prop extension. Rather it was pressing only against the spinner back plate, in this cas a very stiff 1/8" thick backplate, that was able to support the torque value of the bolts, without going back against the prop extension.

We flew the airplane for several hours, blissfully unaware of the problem. Last week Dick used N79RA to take a business associate to the Santa Monica Airport. On his was back he got to within 20 miles of Mojave when a strong vibration became apparent. It steadily worsened, to the point that he elected to turn back to the closest airport at Rosamond. The vibration became much worse and then abruptly went away. Dick thought he had thrown a rod, set himself up for an emergency, dead stick landing on the 2300 foot, Rosamond runway. Dick touched down on the numbers, made the turn off and rolled into an empty tie down. Not until he got out did he realize he had lost the prop and spinner.

Looking at the marks on the drive lugs it is plain to see what happened. The 1/8" aluminum back plate gradually gave way, allowing the bolt tension to relax. Without this friction between the crush plate and prop extension flange to drive the prop, it begins to be driven by the drive lugs and prop bolts in shear. This state of affairs can only continue for a very short space of time, before the bolts fatigue and then of course, the prop/spinner comes off.

This is a very serious situation and anyone who has a Brock Spinner mounted on a prop extension that is made by someone other the Brock

(obviously the Brock extension is completely compatible with a Brock spinner) should immediately ground their airplane and check this out. The problem can be cured by decreasing the radius in the prop extension, or increasing the diameter of the hole in the center of the spinner back plate.

CAUTION
When installing your engine mount, we tell you to set the mount on the extrusions leaving approximately .030 gap between the mount and the firewall, see Section IIL ,page 7. This is true if the mount is perfectly straight, however you should check to see that it is, by measuring from the firewall to the aft of the engine mount and verifying that the mount is at the correct fuselage station as shown in Section IIL, page 14 for conical mounts and page 15 for dynafocal mounts. Bear in mind that even though the mount is accurately welded up on a fixture, when it is normalized by heat treating, it is possible for the weldment to warp, creep or otherwise move enough that if you rely on the .030 measurement, you may have an engine that is not correctly located. Correctly installed, your engine crankshaft should be aligned with the zero buttline, plan view. Side view, the crankshaft should have 2 degrees of down thrust, (+ 1 degree) that is to say the spinner end is higher than the accessory case end.

CAUTION - ROTATION SPEED
Several things influence rotation speed, and thus take-off distance. The fuselage station of the axle centerline is very important. You should hold this within 1/2". (See Chapter 9 and the back cover of Section I). Toe-in of your mains also has a powerful influence on rotation speed (not to mention tire wear!). Accept nothing less than a total of 1/4 of a degree to 1/2 a degree. (N26MS has 1/4 degree toe-in, and still has the original tires, with over 700 landings, 320 hours in one year). If your tires are showing excessive wear, do not accept it, remove the axles and shim them until the toe-in is correct. This can be done quite easily by laying up one or two plies of BID on the strut and bolting the axles back on, gently tightening the bolts until the correct toe-in is achieved (by crushing the BID layup into a taper). Allow the layup to cure, then torque the axle bolts to their proper value of 75 inch/lbs. ft./lbs.). You could also use a commercially available taper shim. Aircraft Spruce sells them in various taper values.

Tire pressure can also influence take-off roll distance/rotation speed (as well as tire wear). Check your tire pressures regularly.

Ground attitude of the airplane can also cause long take-off rolls. Your Long-EZ or VariEze should sit level to slightly nose up on level ground, when loaded to gross weight. If your airplane has a pronounced nose down ground attitude under the above conditions, it should be corrected. Note that a nose-down attitude during construction is normal, before the weight of the engine and wings are added.

CAUTION CP is the latest and best information. We still have questions on this subject. If we put information in the Canard Pusher, it supercedes the information in the plans, and is the correct information to use.

CAUTION - Left Magneto Confusion

This is a problem that could lead to a serious injury. We at RAF have always considered the left and right mags to be as called out by the engine manufacturer. Even though this puts the left mag on the right side of a pusher aircraft, it is still correct to wire your mags and mag switches according to the engine manual. If you wire your EZ switches reversed from the above, obviously you will not have problems, but should you ever sell your EZ, or lend it to another pilot, he or she could get hurt if they tried to start it on the wrong mag (without the impulse) this is particularly true with Lycomings, most Continentals have both mags with an impulse. The impulse allows the spark timing to be at top dead center for easy starting, then advances for normal running. If a pilot attempted to hand prop his engine with the timing set at 25 degrees before top dead center, which is what he would have if he had the right mag switch hot, instead of the left, on a Lycoming powered EZ for example, he is likely to have the engine backfire and injure his hand. It is for this reason the Lycomings and some Continentals are always started on the left mag. If your engine had a tendency to backfire check to see that you have the correct mag grounded.

CAUTION
Carb heat on Continental 0-200 installation. If you have a Continental 0-200 in your EZ, you should test the carb heat for effectiveness. This can be done by slipping a thermometer into a small hole in the hose that connects the carb heat valve with the carburetor. This takes two people, a pilot to sit at the controls and hold the brake while he pushes the throttle to maximum power. The other person should stay well clear of the prop and should insert the thermometer into the induction hose and note the temperature rise after carb heat is applied. There should be a heat rise (carb heat temp. minus ambient temp.) of at least 90 degrees F. If not, you should increase the size or efficiency of your carb heat muff on the exhaust system. Lycomings are not nearly as prone to carb ice as are Continentals, but do not take chances, check your carb heater.

CAUTION - SEDIMENT IN THE RESIN OR HARDENER
Hardener - This is a result of temperature cycling and is not acceptable. Do NOT use hardener or resin that has a cloudy sediment, or solid lumps at the bottom of the container. You must not strain these lumps out, rather you must heat the material as described in CP 29-5 until it goes back into a clear solution, before attempting to use it.

CAUTION - TRAILING EDGE CLOSE OUTS
It is very important for structural integrity, that you ensure that your trailing edges of the canard, elevators, wings, ailerons, winglets and rudders meet the prescribed minimums in the plans. Do not accept delaminations in the trailing edge glass to glass area. Even the smallest delam can get moisture in it which will freeze and expand when you climb through the freezing level, and thus delaminate further and further with each occurrence until it could weaken the overall integrity. About the quality of your trailing edge glass to glass close outs - accept nothing less that perfection in this area. Always

sand smooth every lap after cure - do not leave them joggled as shown.
SKETCHES OMITTED

LAP DIMENSION Ignoring the proper procedure here could result in serious consequences, even structural failures! Here is a list of these areas. The minimum dimension should be considered an absolute minimum. If you don't meet this criterion it requires repair before you fly.

	Glass Lap Dimension Shown	Minimum Acceptable Lap
Canard	0.45"	0.3"
Elevators	0.25"	0.2"
Wings	0.6"	0.5"
Aileron cut outs	1.0" (top)	0.75" (top)
	0.75" (bottom)	0.52" (bottom)
Ailerons	0.5"	0.3"
Wing Root Rib	0.6"	0.4"
Winglets	0.6"	0.4"

SKETCHES OMITTED

CAUTION: Nose Gear Pivot
Correctly installed, the pivot axis should be between vertical and 5 degrees from vertical with the top aft. See sketch on page 13-1, Section I. We recently saw a Long-EZ that had the pivot oriented top forward. Under these conditions, the nose wheel is susceptible to violent shimmy which will fail the fork. Never taxi or fly an EZ if the shimmy damper is not set within limits.

BUILDER HINTS
Clarification on use of various pop rivets. Anywhere on the airframe where you are installing nutplates, on hinges, access panel, use 3/32" diameter flush pop rivets, or solid aluminum rivets. When installing aileron hinges onto the ailerons, use 1/8" round head pop rivets (Avex 1601-0410, or cherry MSP 43) rudder hinges are installed into the rudder using flush pop rivets (Avex 1604-0412 or cherry MSC 43). CS2 elevator hinges are installed on the elevator using flush pop rivets (Avex 1604-04 or cherry MSC 43).

Zolatone cockpit interior paint, is now stocked by both Wicks Aircraft Supply, and Aircraft Spruce. This paint really dresses up the interior, and is easy to apply. Mike used Charcoal Gray #40-59, and applied the Zolatone directly onto the bare fiberglass. You should scuff the shiny glass interior with 40 grit sandpaper before spraying the Zolatone. Mike did not use a primer or undercoat, the Zolatone is adequate UV protection without a primer.

Jim Heir, Colorado Springs, CO sent in an excellent suggestion for maximum utilization of space. He built a storage cabinet on the wall of his garage, with a large door hinged at the bottom. He stores his rolls of UND and BID glass inside and when he needs to cut glass, he pulls down the door, which has two legs hinged on it, and it becomes his cutting table. He also marked the surface of this table with a magic marker with 45 degree and 30 degree and 90 degree lines every 6 inches. This makes it real simple to cut the necessary glass pieces,

then close and latch the door, which keeps the rolls of glass from becoming contaminated. **SKETCH OMITTED**

When installing the Task Research fuel/baggage strakes, be certain to remove all peel ply, from inside and out. There should be two plies of peel ply, about 5" wide oriented diagonally, (see Section I, page 21.-4) which will leave a slight depression once they are removed. This depression will be filled with the one ply UND strip that laps from the top of the centersection spar, diagonally forward and around the leading edge of the fuel strake. This holds true top and bottom. Do not forget to remove the two plies of peel ply. Important this one ply of UND strip must lap from the strake onto the centersection spar smoothly, without a joggle. Sand any joggle into a smooth taper before the UND strip layup. See sketch. Next page. **SKETCH OMITTED**

Centersection Spar Clarification. A few builders have been having problems understanding the sketch in Section I, page 14-2, top right. This sketch is correct, and it shows the line you should follow on the aft face of the spar box, when you cut through the CSI foam aft face. The dimension .55" at the outboard ends is correct. The spar cap at this point is only .150" thick (top cap) and .113" thick (bottom cap). This is because the spar box top tapers to match the wing root airfoil. If you look at page 14-9, Section C-C you can see the original outside shape of the spar box shown as a dashed line. If you measure down the aft face (CSI) top aft corner to the foam under the shearweb, layup #5, you will see that it is .55". Note how the spar cap templates (page AII) set this taper. The template outside edges are level waterlines. **SKETCH OMITTED**

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.

DES Desired - strongly recommended but not requiring grounding of the aircraft.

OPT Optional - does not effect flight safety.

OBS Obsoleted by a later change.

MEO Minor error or omission.

LONG-EZ PLANS CHANGES

LPC #95 DES, Section I, page 16-2, step 3, paragraph 1, last sentence. Pivot hole drilled to 23/64" (0.359). This results in an extremely tight interference fit,(0.016) and it would work better using a letter "U" drill (0.368) & better yet if you then ran a 3/8" press fit reamer (approximately 0.373) through the hole.

LPC #96 MEO, Section I, page 21-5, drawing at lower left.
Material for fuel valve mounting bracket should be 0.062 2024-T3 aluminum. The fuel valve handle should be trimmed down to clear the instrument panel.

LPC #97 MEO, Page A-14, lower winglet, tip template.
The arrow pointing inboard is correct, the words, "this side for lt.....", etc. are reversed. The side shown is for the right winglet, transfer numbers to the other side for left.

LPC #98 OBS, Section I, page 22-6, center drawing.
Delete "yaw trim bracket".

LPC #99 DES, Section I, pages 14-10 & 14-11, Sections E-E, F-F, G-G & H-H. The UND layup #3 & #4 are incorrectly shown to lap onto the CS7 & CS8 bulkheads. The words describing this layup on page 14-2 are correct. Layup #3 & #4 are layed up onto CS2 & CS3 in Sections E-E & F-F and only onto CS1 in Sections G-G & H-H.

LPC #100 MEO, Section IIL, page 6, left side, center of page.
"you will now have 4 AN509-10R8 screws....." should be 3 AN509-10R8.

LPC #101 MEO, Section IIL, page 37.
Add to the Brock parts list - two spacers, part #SP-5. These spacers are used as stand-offs to bolt the gascolator to the firewall.

CLARIFICATION

Section IIL, page 37. Part #LL-4 is used to stand off the mixture cable clamp, and is shown as a 5/8" long stand off tube on page 16. Part #LL-3 (page 37) is used inside the AN111-4 bushings in the throttle & mixture arms, and is shown as a 1/4" x 3/16" x .25" spacer on page 17.

FOR SALE

For those who would like to purchase an orifice fitting, rather than make one (CP 31, page 5, 2nd paragraph). The orifice fitting (a 45 degree elbow) required in the oil pressure - sensor line is available from: Yingling Aircraft
P.O. Box 9248
Mid-Continental Airport
Wichita, KS 67277
(316)943-0231

Order Part #0752037-3 for $21.50 plus $2.00 for postage and handling. We recently saw an excellent little panel light (very light weight), low drain and adjustable. This light is available from: David Hoffman Products
1009 Old Mill Road
Auburn, AL 39830

For Sale - Lycoming O-235-CI, 1200 total time, zero since major. Standard crank and cylinders, oil pump. A.D. complied with. $4,500 - call 707-433-6480.

For Sale - Lycoming or Continental Engines.
Norm Bender
Box 30343 AMF
Memphis International Airport
Memphis, TN 38130
(901)794-0032

For Sale - Brand new B & T propeller, 59 x 75 for Lycoming SAE #2 flange $230. Call 916-624-2119

For Sale - VariEze propeller, Great American, 56 x 68 used for 30 minutes. $200 delivered.
Call 203-666-3560 after 5pm EST
Norm Rossignol
122 Eagle Drive,
Newington, CT 06111

Bob Hansen, Long-EZ builder/flyer (N7LZ) has developed a neat program for use on a hand held TRS-80, pocket computer. Bob's goal was to replace the Owners Manual with the computer. The pilot has only to answer the questions posed to him by the computer to get all the significant performance answers. Bob admits that there may still be a few bugs in the program, but feels that it is a big jump over starting from scratch. Bob will sell any builder/flyer a commented program listing and a magnetic tape cartridge for $5.00.
Bob Hansen
22319 Marilla Street
Chatsworth, CA 91311

Spectro-Chem, Oil Analysis, a service we mentioned in CP 30, page 3, has had a price increase. Their price is now $8.95 per kit in lots of twelve or more.
Spectro-Chem

P.O. Box 29074
Phoenix, AZ 85036
(602)253-6515
Contact Lou Brand and identify yourself as an EZ builder/pilot.

VIDEO TAPES
RAF now has available a two cassette volume that contains the original "Building The Rutan Composites" as well as "Flying Is VariEze", "Defiant" and "Go-A-Long-EZ". All four programs run for a total time of 2:41. All of the above for $99.95.

We still have the single cassette of "Building The Rutan Composites", running time is 1:36 for $59.95.

California residents should add 6% sales tax and shipping to anywhere in the U.S. and Canada is $4.00, all foreign orders, add $8.00. Both of the above are available in the European PAL system.

For Sale - Lycoming O-235 (80 octane), 600 hours total time since new. NO recent Ad's apply, removed from Piper Clipper and pickled. $1,800.00.
Dan Duncan
405-439-2473

WANTED - Original main gear strut for VariEze.
Roger Kelm
11020 Harlan
Westminister, CO 80020
303-466-4719

Main Gear And Nose Gear Struts. Of all the parts manufactured for the VariEze and Long-EZ, the ones that have provided the most challenge for us has been the S-glass gear struts. The original manufacturer began producing them in 1976. In July '79 he discontinued production, following a series of manufacturing and marketing difficulties. At that time we were unable to locate a shop who could produce the parts at an acceptable price. A better manufacturing method was required. RAF then developed the production equipment and began producing parts. RAF's policy is to only sell plans and not parts, so in mid 1980 we turned the equipment over to Task Research after it was well proven by producing 200 shipsets. RAF continued to retail the gear so we could inspect each one for quality. Task's quality has been superb, a mold-offset problem being solved with new, expensive metal tooling. Satisfied with Task's capability, RAF now no longer retails the struts.

The main struts are $326.00 and nose struts are $58.50 contact Task directly.

TASK RESEARCH INC. has for immediate delivery:
Main gear struts,
Nose gear struts,
Fuel baggage strake kits - 16 pcs. including ribs and baffles.
Fuselage Bulkheads - side consoles & roll-over structure. SASE for info sheet.

Task still have a few reject strake pieces at the discounted prices. Go to Task to inspect.

Task Research Inc.
848 East Santa Marira,
Santa Paula, CA 93060
Order Phone # 805-525-4447

SOARING IN A LONG-EZ?
A month ago, on a Sunday, Mike was up over the Mojave Airport in N26MS. He was doing a fuel flow evaluation. It was a very windy day (50 knots at the airport) but clear. During the course of the test the right tank was deliberately run out of fuel, to the point that the engine quit completely prop stopped, at which point he found himself climbing at 800 fpm! He started his elapsed timer and 42 minutes later, having gained 3,100 feet of altitude he gave up and returned to the airport. The strong lift over Mojave airport was apparently a wave condition, and had he been dressed better (warmer) he could have stayed up for much longer. He had to come down due to being very cold, not because he ran out of lift. Someday, dressed more suitably, he intends to try again.

Mike and Sally's son Keith, was involved in an accident about a year ago, which left him without the use of his legs. Keith had always wanted to fly the Long-EZ, and toward that end, Mike recently installed a temporary rudder/brake system in the rear cockpit. Keith has now flown a total of 5 hours in the front seat and is doing very well. He is hoping to go all the way through his private pilot's license in the Long-EZ. As far as we know Keith is the first paraplegic to fly a Long. Mike and Keith are working on a rudder brake system that will be hand controlled from the front seat. The Long-EZ has worked out amazingly well in this application. Keith's only prior experience was about 2 hours in a glider. He has not made a bad landing so far.

CP32, Page 8

VARIVIGGEN NEWS.
Another VariViggen first flight to report. We do not have any details or photos, but Bernard Duneman (N33VV) from Minneapolis, MN. Bernard wrote us a note saying that his first flight was on November 16, 1981 and everything went well. At this time he is progressing towards having the restrictions flown off and he expects to make Oshkosh. Congratulations Bernard!! Judging by letters received from builders/flyers, we could have four or five Viggens on the line at Oshkosh '82! Now that would be something.

N27MS continues to run well, unfortunately I don't seem to have time to fly her as much as I used to, but when I do, I am always impressed at the rapid roll rate and outstanding crosswind capability. I don't believe there is a light plane that handles better in a crosswind, at least I have not flown one. I have just done an annual inspection on the Viggen, and the only discrepancy was a crack in the aluminum carb heat box. This same problem occurred once before at about 40 hours, I rewelded it and it has held up ever since. This time I removed the offending part, which I made myself originally, so hopefully that problem will go away. Frankly I was very pleased to find so few problems. I lubricated the nose and main gear retract systems, and checked for wear, neither system required adjustment. Surprisingly I have not adjusted them since before first flight, four and a half years ago. Not flying her as often as I used to I have noticed that I

neglect tire pressure checks. This caught me out the other day when I pulled the valve out of the inner tube in the nose wheel tire. I had to replace the tube, but it shows that tire pressure must be checked. My Viggen is a little heavy at 1252 lbs. empty, so I use a little higher tire pressures than what is called for in the owners manual. For my airplane I have found 45 psi for the mains (Goodyear 500 x 5, 6 ply Flight Custom II) and 50 psi for the nose. I have been getting excellent tire life, and would recommend these pressures, particularly if your Viggen is close to my empty weight.

Incidentally, I use 100 psi in the nose strut, and I have seen virtually no loss of pressure. I have only inflated it if I have been working on it, changing fluid, etc. It has been literally flawless. Another area where I have seen degradation has been the exposed wood around the rims of each cockpit. This wood was originally painted with clear epoxy, and has been degraded by ultra violet and then moisture has got into the wood and cracked the surface. I will need to scrape it down and reseal it, perhaps with Saf-T-Poxy (low water absorption) and then I will paint it with an ultra violet barrier. Those of you who may be at this stage should give this some thought. Do not leave unpainted any epoxy or wood surface that is exposed to sunlight.

The canopy latches should be given very close attention. The plans built latches are by far the best and safest. Those of you who have seen my Viggen will know that I have had several different latch types on the airplane. For my own experience I cannot recommend what I have done. I have had my front canopy open in flight on three occasions, any of which could have resulted in an unpleasant accident. After the first two incidents, I changed my front canopy latch to a pretty fancy aircraft grade type of latch that provides a "safety" position as well as a locked and unlocked position. I was entirely satisfied with this, and felt that there was no way for it to happen again. Wrong! Circumstances can really get you in trouble. To make a long story short, I failed to lock it and for some reason the "safety" feature also failed. So I took off, hurrying to catch up to Sally, just as I was joining up with her, at only 200/300 feet, my canopy opened. I saw it out of the corner of my eye, and grabbed it with my left hand just as it reached its maximum open position. I pulled it down, moved out of formation, held the stick between my knees, and locked the canopy. My heart was going 19 to the dozen, and I consider myself lucky to have got away with it. When something like this happens, it is quite frightening, and you really feel a strong urge to panic. You must quell this, and CONTINUE TO FLY THE AIRPLANE and then lock the canopy. The reason for bringing this up again, is that I occasionally hear from people wanting to change things, including canopy latches. The best advice I can give is DON'T. Remember that we have built the airplanes per the plans and flight tested them and all of their systems. The plans built parts such as canopy latches, will work as advertised, as will fuel systems, etc. If you change any of these things, remember, when you first fly, you will be testing untried systems that may or may not work. Be prepared to take whatever action may be necessary in case you have a problem.

Speaking of problems, several builders are still using the cable driven main and nose gear systems. Based on my own as well as almost all the Viggens that have flown, I feel you are taking an unnecessary risk. ALL of the cable driven systems that I know of, have had at least one

failure. The worm/ worm gear and chain systems installed in N27MS and called out in the second edition of the VariViggen plans, has performed flawlessly, and is the only system currently recommended by RAF. We do still have plans available for the main gear retract system.

Several builders have called or written, asking if there is a VariViggen club, or if not, could one be formed. I think this is a good idea and would be happy to try to form such a group. Any builders willing to help others, show their projects or completed airplanes, talk on the phone, answer written questions, or just provide moral support, and are willing for me to provide their names, addresses and phone numbers to inquiring builders, please let me know.

FOR SALE - VariViggen project. Fiberglass parts, wing attach fittings, 500 x 5 wheels and brakes, master cylinders and brake pedals. Will trade for Long-EZ parts.
Contact. Ron Lorimor.
P.O. Box 992,
Yreka, CA 96097
(916) 842-3008

Elmer Hamerick reports that he purchased a flap motor, complete with ball screw, 2 micro switches, (out of a Cessna 150) which he intends using for his reflex drive. Elmer purchased the flap motor from:

Ellington Aircraft Salvage,
30982 E Broadway,
Toledo, OH
419-666-2440

A similar flap motor is also shown in the latest Wag-Aero catalog, page 50. Part # 1-205-000

A letter from VariViggen owner, Len Dobson.
N73LD, Serial #533 was built from the first edition VariViggen plans, including the cable retract system. However, before skinning the aircraft I removed the cable system from both main and nose gear assemblies as it was far from being trouble free. About the time Mike came out with the drawings for his gear modification, I had already devised and installed a chain drive system. This system appeared to be quite reliable during ground tests so I completed the aircraft. All went well for approximately 100 landings. However, I had not anticipated the stretching of the chain with continued use. Even though I had installed idler sprockets in the system, they were apparently not enough to take up the slack in the drive chains caused by the stretching.

On December 1, 1981 while landing at Brenham, Texas in a 30/35 knot cross wind the right down lock cam MG 5, slipped out of the notch on beam MG 4, putting all the side load on MG 6 push rod and MG 5 cam.

The gear had been extended on the down-wind leg, and I had three green lights on the panel on final approach. The limit switches on my gear system are expensive aircraft type environmental micro-switches, and they

were adjusted for positive over-center down lock. The slack in the chain combined with the poor configuration of the notch in beam MG 4, (which I had purchased from a vendor), caused the cam to slip off the beam and fracture. (See drawing) I had rolled about 200 feet after touch-down right down the center line with the aircraft under full control, when a sharp gust hit the aircraft from the left. I heard something snap, and the right wing tip dropped to the runway. I was still rolling at about 60/65 mph, and I was unable to keep the aircraft on the runway because of the drag. The infield adjacent to the runway was quite soft and muddy from recent rains, and as the nose wheel dug in, the strut and nose gear assembly tore out of the side bulkheads F 12, 16, 17 and 31 between F20 and F 32. For just a brief split second it felt as though the Viggen was about to cartwheel, but it fell back as the nose gear folded, and then the left main collapsed inward. At this point the aircraft was completely flat on the bottom, and it skidded on the wet grass on its belly with mud and grass flying over the canopy for about 300 feet before coming to a stop.

Retrieval was accomplished without further damage mainly through the efforts of my good friend Dr. Norman Gabriel and Brenham, Texas who is also a Viggen builder.

I was quite surprised and pleased to see how well the airframe stood up. My only injury was a bruised right toe caused by the rudder pedal tearing out. Damage to the Viggen consisted of moderate skin damage to the belly, nose wheel well bulkheads, right brake line, right rudder pedal, entire nose gear assembly except for the wheel and fork, and the main gear retract system.

My VariViggen is flying again, but this time with the Melvill gear modification, and believe me - don't fly without it!!!! The modification was difficult to retrofit with the skin on, but not impossible - nothing comes "EZE" on the Viggen. The modifications and repairs took about three months, "Blood, Sweat and Tears" went into making it a much better ship than I had before.

New World Records Set By Long-EZ
Dick Rutan, who has set three world distance records, two in Long-EZs and one in the VariEze prototype, is at it again. This time, joined by Jeana Yeager, they have set five new speed records. World speed records are categorized by weight and by distance flown. Separate records are recognized for female pilots. The weight category is C1b, for light planes under 1,000 kg. (2,205 lbs.). Speed records are recognized at distances of 3 km., 500 km.,1,000 km. and 2,000 km. Due to the Long-EZ's capability of flying long distances at high speed Dick and Jeana attempted to break the following previous records:

Speed C1b absolute closed course.

500 km.	USA	G. Mock	Aero Com 200	1965	206.7 mph
1,000 km.	USA	H. Fishman	Waco Meteor	1969	200.4 mph
2,000 km.	CZECH	L. Stastny	Sokol CK-CLE	1956	173.7 mph

Speed C1b female closed course.

500 km.	(none set)				
1,000 km.	CZECH	V. Touzimska	Sokol L-40	1980	131.4 mph
2,000 km.	CZECH	V. Touzimska	Sokol L-40	1980	128.9 mph

To put things in perspective, the 2,000 km. speed record requires a full throttle dash at low altitude a distance equal to a trip from Los Angeles to Dallas! Dick and Jeana's non-standard Long-EZ (O-320 Lycoming and some structural mods) attains a true airspeed of 223 mph (194 kts.) when clean. This slows to 212 mph (184 kts.) when all the leading edges are clobbered with bugs (loss of laminar flow). Speed records are set by block speeds, however, resulting in losses due to wind and turns at each end of the course.

The attempts were not as easy and straight forward as one might have hoped. On Dicks first attempt, he experienced a broken aluminum fitting (remember CP 31 changes?) in the fuel system which dumped about 5 gal/hr through the engine compartment - luckily no fire, but it resulted in inadequate fuel to go the distance. Two of the record runs were done in rain showers, resulting in extensive prop damage at the 3,000 rpm condition he was running. In all the attempts, the 0-320 logged over 25 hours of time at 108% of rated power, at 11% over rated rpm, without problems. The Microlon manufacturer sponsored the attempts. The engine was treated with Microlon oil treatment. Room here does not permit the full story of the attempts - this should appear in the aviation press. Attempts in all record categories were successful, the new world records are listed below. Long-EZs now hold 7 world records!

Record	Pilot	Dist. km.	Speed mph
Absolute	Dick	500	211.51
Absolute	Dick	1,000	207.84
Absolute	Jeana	2,000	204.58
Female	Jeana	500	207.10
Female	Jeana	1,000	205.00

LONG-EZ FIRST FLIGHTS
There are now 16 Long-EZ's flying, that we know of. If you know of one not shown in CP 31 or below, please let us know his or her name, address, N-number and date of first flight.

Herb Sanders	TN	N81HM
Bryce Heffley	CO	N78AB
Paul Adrien	MA	N46AA
Sam Harris	MS	N766SP

VARIEZE FIRST FLIGHTS
Since the last report, the following VariEze's have flown. If you know of one not shown below or in a previous newsletter, please let us know his or her name, address, N-number and date of first flight.

Shirl Dickey	UT	N60SD
Dave Cherwink	MD	N78JH
Earl Ellis	OH	N547EZ
Dale Collins	IL	N224DC
George Holmes	CA	N104P
Bill Butters	MO	N235LB
Tom Richards	WA	N18TR
Gerold Edmonds	WY	N81JC
Ronald Atkinson	IN	

Joseph MacDonald	PA	N13JF
Don Youngs	CA	N33ST
Don Jones	TN	N300DJ
John Fowler	IA	N82JF
Stephan Sorenson	CA	N118SJ
Curtis Barry	TN	N778CB
Dan Patch	CA	N862DP
Bob Zahner	FL	N1RZ
Steve Good	IN	N79SG
Ernie Joiner	CA	N444EJ
Terry Hastings	CA	N80TC
Doug Westin	NY	N42DW
Jack Walker	FL	N52EZ
George Ehlers	WA	N1122
Bill Marsh	CA	N404EZ
Wayne Dize	VA	N2DZ
Seth Hancock	TX	N80SH
Kurt Duncan	FL	N14KM
Richard Jones	MO	N314RJ
James Selzer	NV	N4266X
Robert Abresch	TX	N80KB
Charles Hammond	TX	N11CH
Stephen Alexander	IN	N711VE
Wally Loewen	CA	N80WL
Dan Zoerb	TN	N715DD
Ed Regis	WA	N8034U
R. Martin	AZ	
Harold Wilcox		N112EZ
Raymond Johnson	CA	N555EZ
Stan Rawllins	WA	N301SR
Charles Dunn	KS	
Bob Cummings	CA	N774
Sam Sweeney	CANADA	NOG 1HO
Yves Leipert	FRANCE	FPYKO
Henri Christ	FRANCE	FPYIP
Pierre Casals	FRANCE	FPYJO
Laurent Morelle	FRANCE	FPYHT
Kjell Pyrtz	NORWAY	

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Robert Schubiger, Switzerland. He keeps his VariEze at home, hangers are difficult to get and very expensive. Robert is an airline pilot and flies DC10s.

Rudi and Dane Kurth's VariEze, was the second EZ to fly in Europe. Rude attends many airshows all over Europe. He is seen here at Leicester Air Show in England.

G-LASS, the first VariEze to fly in England, owned by Don Foreman and the holder of several point to point world records.

F-PYHR is owned by Monsieur Briquet.

Monsieur Morelle's (F-PYHZ) and Monsieur Guimbal's (F-PYHT) also at the Leicester show.

F-PYIP, is owned and operated by the Peugeot Aero Club in France.

Monsieur Morelle taxiing out for his first flight.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

The Grizzly, shown above in slow flight with full flaps. The Griz has been a low priority project because of other commitments, but is a lot of fun to fly, and Burt and Mike fly her every chance they get. The photo below was taken out the right 'blister' window, and shows 60 percent flaps down, the fuel gauge and fuel sump blister on the fuel tank (wing interconnect) and her shadow framed by the wings and fuel tank. Photo by Pat Storch.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.3ft
Area	94.1 sq. ft.
Empty Basic	750 lb.
Empty Equipped	800 lb.
Solo Weight	1000 lb
Gross Weight	1325/1425 lb
Max Fuel	54 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	600/950 ft
Climb (solo/gross)	1750/1250 fpm
Cruise 75% 8000 ft	189 mph
Cruise 40% 12000 ft	146 mph
Max range * 75% (solo/2 place)	1380/1150 mi
Max range * 40% (solo/2 place)	2070/1690 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the complete plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 larger full size drawings. It includes many photos, over 800 drawings and illustrations, and over 65,000 words. The builder is led, step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction manual for the complete engine installation including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.
SECTION IIA - Continental 0-200
SECTION IIC - Lycoming 0-235

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

LANDING BRAKE - Complete full size drawings for the landing drag device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail	Overseas, Airmail - U.S. Funds only
Rutan Aircraft Information Package-complete data and photos of all Rutan Aircraft designs.	$ 5.00	$ 6.00
"Canard Pusher" newsletter. Published quarterly. One year subscription. Approx 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIC Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00
6% tax, if Calif. order. Newsletter not taxable.		
TOTAL		

LONG-EZ NOW APPROVED FOR GRASS FIELDS.
Rutan Aircraft has recently tested a spring loaded "shock strut" which was installed in place of the NG9/NG10A nose gear strut on Long-EZ. This, combined with 500 x 5 tires, was tested by progressively taxiing over 1" x 2"'s, 2" x 4"'s and finally over two 2" x 4"'s, one on top of the other. The results showed a very significant increase in the rough-field absorption qualities of the landing gear. Taxiing over stacked 2" x 4"'s resulted in very acceptable loads, with a satisfactory ride.

We then flew N79RA to an average grass strip and conducted takeoffs and landings at a range of weights and cg positions. Also, taxi tests in tall grass and undulating surfaces was satisfactory. A Long-EZ with the spring strut and 500 x 5 main tires is now approved to operate from average grass fields. This does not mean it is acceptable for gravel or unprepared/rough surface. The prop damage that can result from operating on gravel is unacceptable. The spring strut will be available from a Long-EZ distributor as an option.

THE FOLLOWING ARE RAF-AUTHORIZED DISTRIBUTORS OF LONG-EZ MATERIALS AND COMPONENTS. CONTACT THE DISTRIBUTORS AT THE ADDRESSES SHOWN FOR THEIR CATALOGS AND DESCRIPTION OF ITEMS.

ALL RAW MATERIALS & COWLINGS

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow Ave, Bx 424,
Fullerton, Ca 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT SUPPLY
410 Pine
Highland, Il 62249
(618) 654-7447
Catalog $3

KEN BROCK MANUFACTURING, 11852 Western Ave., Stanton Ca 90680 (714) 898-4366: Control system parts and all machined or welded parts, fuel caps, engine mount, rudder pedals and exhaust system. Catalog $3

PLEXIGLASS CANOPY BUBBLE, NOSE & MAIN GEAR STRUT
RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This poster is now available from RAF. It is in color, 11 x 7 for $2.00 each plus $1 for postage. They are autographed by Burt and Mike.

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 33. If you are building from 2nd Edition plans you must have newsletters 18 through 33. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 33. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 33. If you are building a Long-EZ you must have newsletters from 24 through 33.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

Please note that RAF is closed during the year on the following holidays:

New Year's Day	January 1.	
Memorial Day	May 30	3 day weekend.
Independence Day	July 4	3 day weekend.
Labor Day	Sept 6	3 day weekend.
Thanksgiving	Nov 25	
Christmas Day	Dec 25	3 day weekend.

RAF will be open during Oshkosh. On the 1st and 7th of August we will run the videos and the prototype will be here. There will be no flying. Builders please note that there will be no one to answer builder questions during that two weeks.

RAF ACTIVITY
Since the last newsletter has involved flight testing of our new Solitaire self launching sailplane, development of aero tow capability with the Grizzly, competing in the 1982 Cafe (Competition in Aircraft Fuel Efficiency) race, homebuilder support, various technical lectures and presentations and several aerodynamic and structural consulting jobs.

OSHKOSH 1982
The world's largest airshow and convention, the EAA flyin at Oshkosh, Wisconsin, July 31 through August 9th should prove to be an interesting one this year as several new RAF-designed aircraft plan to make their debut: the new Solitaire sailplane, the STOL Grizzly, the Amsoil Biplane Racer, and the NASA skew wing AD-1. Demonstrations are planned by the Solitaire being towed by the Grizzly as well as Long-EZ flight demonstrations. In addition, Long-EZ's and VariEze's are expected to race in the LBF Oshkosh 500 race. The arrival of the NASA skew wing AD-1 is significant in that although the aircraft was completed in 1979, Oshkosh 1982 represents the first public showing of the AD-1 and flight demonstrations are planned. Old time readers of the Canard Pusher will recall that the AD-1 began as an unsolicited proposal by RAF to NASA in late 1975. The aircraft was designed by RAF in 1976 - 1977 and built by Ames Industrial Corp. in 1978/1979. Raf had hoped to also unveil the small twin engine jet trainer demonstrator, the Fairchild NGT. However, since source selection for the Air Force trainer competition has not yet been made, the NGT will remain at RAF awaiting the possibility of additional flight testing. FLASH - As we are going to print it has been announced that Fairchild Republic has won the Air Force trainer competition!

Discussion and technical presentations by RAF at this years Oshkosh event are listed below.

Date	Time	Place	Subject
Aug 1 Sun	3:00pm	Tent #2	Long-EZ
Aug 3 Tues	3:00pm	Tent #2	Solitaire
Aug 4 Wed	3:00pm	Tent #2	Grizzly
Aug 5 Thurs	10:30am	Tent #1	Aerodynamic Features of the Tandem Wing.

SOLITAIRE COMPLETES SELF-LAUNCHING & AERO TOW FLIGHT TESTS
The new Solitaire has exceeded its design goals on performance and has proven to have flying qualities that represent a significant improvement over currently available sailplanes. The Solitaire is the first high performance sailplane that exhibits true stall-proof flying qualities, allowing slow thermalling flight and return to airport after rope break without the high risk of stall or departure. The visibility is excellent with the canard providing pitch and roll attitude reference. The wing "spoilflaps" have proved to be very effective for flight path control and result in a very minor pitch trim change. The directional stability and tow qualities are excellent and do not result

in the tricky aero two characteristics normally found on the very small conventional sailplanes.

As shown by the accompanying graph, the static pitch stability of the aircraft is quite high, resulting in a relatively large elevator travel with speed and a minimum trimmed "full aft stick" speed of 34 knots. During powered flight the thrust trim change due to the high mounted propeller is minor due to the 4 degree propeller thrust angle. Initial testing indicated an apparent over-sensitivity during flight in turbulence and during tow plane wake transitions. This was traced to a combination of incorrect gearing in the pitch control system and excessive control system friction. Improvement of those items has resulted in satisfactory longitudinal flying qualities. Continuous flight in tow plane wake is possible without overcontrol tendencies. The initial configuration proved to have inadequate roll rate to allow rapid thermal side step maneuvering. The roll rate was similar to the larger open-class sailplanes. By the time you read this newsletter, the roll rate should have been improved by a modification to the ailerons increasing their span, deflection and chord. Directional stability and control is excellent as is the nose gear steering of the bicycle-wheel configuration. Unlike most sailplanes the Solitaire can be taxied or towed to the active runway without ground handling requirements.

The accompanying figures show the measured soaring performance of the Solitaire, conducted in still air by timing decents through 300 to 500 foot altitude bands. As shown in the comparison, the Solitaire performance lies between the 1-36 and the 15 meter 1-35 sailplanes. This is exceptional performance for its 12.5 m wing span. The minimum sink rate at sea level of 135 fpm should allow thermalling capability even in the relatively weak Midwest soaring conditions.

The development of the motorized self-launch capability is being conducted using two general power concepts. After evaluation of both has been done, one will be elected for the plans configuration. The first involves a fixed, single cylinder, two cycle, seventeen horsepower engine with carburetor and exhaust system mounted in the forward fuselage. A row of three V belts connects the engine to a retractable boom which houses the top bearing pulley, flange, and 42 inch propeller. This is the configuration that was used for the initial flight tests. Following those tests the aero tow development was conducted. The aircraft was initially towed with a Super Cub and then the Grizzly. Aero tows

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have been satisfactorily conducted in strong gusty winds to 30 knots and crosswinds as high as 15 knots. The second propulsion concept considered involves a light weight (18 lbs), two cylinder, two cycle engine with a direct-drive propeller that is retracted on a boom. The engine, carburetor, exhaust system and propeller installation in its entirety is extended from the fuselage for self-launch. This system is undergoing ground testing and should be flying soon. We at RAF are looking forward to our entry in the Soaring Society of America's homebuilt sailplane competition to be held September 4-6 at Fantasy Haven Airport in Tehachapi, California. The goal of the competition is

to promote soaring by the availability of a low-cost homebuilt sailplane.

SOLITAIRE PERFORMANCE CHARTS OMITTED

EZ's SWEEP THE CAFE FUEL EFFICIENCY 1982 COMPETITION!
The prestigious Competition in Aircraft Fuel Efficiency race held this year at Santa Rosa, California, served as a dramatic demonstration of high efficiency and utility of RAF homebuilts. As shown in the adjacent tables and charts the EZ's swept the first four places in the two-seat experimental category. Dick's Long-EZ, carrying three people (a total of 600 lb. payload) placed first, above all other experimental aircraft. The RAF Defiant, carrying an impressive 1,200 lb. payload (six people) placed second in the Experimental category. Mooney's noted designer Roy LoPresti flying a Mooney 201 with (five seats occupied), won the production single category and edged out the Long-EZ's Cafe score by approximately 3%. Overall placings are shown in the adjacent table.

The impressive lineup of over 50 airplanes ranged from single seat Quickies to the high performance Piper Aero-Star. The planned 400 mile race course was shortened due to a thunderstorm at the third turn point which was the top of 10,560 ft. Mount Lassen. We would have expected the EZ's to score even higher had the Mount Lassen turn point been included due to the excellent high altitude efficiency of the EZ's. The race was accident free, the only incident being a tailwheel failure of a Q2 on landing and a Q2 which experienced engine failure on initial climb but landed safely.

The officials, headed by Dr. Brien Seeley, should be commended for the through and professional way in which the competition was run. The enormous job of handling the weighing, impounding, timing, and payload determination of that large a group of dissimilar aircraft is no minor task. The weighings this year were accurately measured and averaged by sophisticated equipment. Thus, the suspected inaccuracies of last year that may have distorted some of the results (particularly on the lighter aircraft) probably did not occur. The CAFE score this year was computed as CAFE = MPG x MPH x payload. Last year's equation was CAFE = MPG x MPH x the square root of payload. We calculated scores using last year's formula and this year's data to assess the results that would have occurred if the 1981 formula had been used. The adjacent table shows that the result would have Gary Hertzler's VariEze placing first overall, with this year's winner (the Mooney) placing sixth.

In order to visualize the relative efficiency, a graph of miles-per-gallon versus miles-per-hour is shown for two and three place experimentals. **GRAPH OMITTED** Note that the Long-EZ's performance was close to the handbook data for continuous cruise (at the 3,000 ft. average race altitude) even though the CAFE course required extra fuel and time for takeoff, climb and winds aloft. The two-seat experimental winner, Gary Hertzler, flew an A-80 Continental powered VariEze. He prepared for the face by gathering extensive fuel flow data and conducting a technical computer analysis to optimize his speed and climb/descent strategy. Gary capped off a successful race weekend with a spectacular non-stop flight back to his home in Phoenix.

In developing a formula to assess aircraft efficiency, the question always arises of how much importance to place on speed. The CAFE 1981 and 1982 formulae place equal importance on miles-per-gallon and miles-per-hour by multiplying their values together. A solution to the question of speed's degree of importance has been proposed by Don Crawford and, as a result, "Honorable Mention" prizes were awarded this year based on his analyses. The winners were determined by constructing "first echelon" and "second echelon" surveys of efficiency, in which equal award is given to the best

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slower (but high mpg) aircraft and the best faster (but lower mpg) aircraft. The first echelon represents a group of first place winners and the second echelon represents a group of second place winners. The Crawford "first echelon" went to the VariEze, Mooney 201, Defiant and Bonanza. The "second echelon" prizes went to the Long-EZ, Twin Comanche and Glasair.

In general, twin-engine aircraft are less efficient than single engine aircraft, thus the CAFE prizes are separated to group the twin-engine aircraft together and allow them to compete against each other. Their places and scores are shown in the adjacent table. It is interesting to note that even though the RAF Defiant is a twin engine aircraft it was surpassed only by the Mooney 201 and Long-EZ in the overall CAFE scores.

Each year as we participate in the CAFE efficiency contest we learn new and better ways to improve aircraft performance..This year Peter Garrison, the Flying magazine writer who entered his long-range Melmoth, had prepared a complete computer program to analyze the entire race course and to assess the effects of different climb and descent strategies. We expect the refinements done for this prestigious competition may result in the improvement of general aviation efficiencies. We would not be surprised if someone was able to score in excess of 3 million during the next CAFE competition.

CAFE 400 - 1982
EXPERIMENTAL CATEGORY: TWO SEATS.

#	Score	Aircraft Type	Pilot	Payload /Seats	Speed	MPG
1	2217637	VariEze	Hertzler	400/2	137.6	40.29
2	2124503	VariEze	Lombard	400/2	154.4	32.77
3	1919920	VariEze	Clark	368/2	167.2	31.24
4	1919121	Long-EZ	Melvill	400/2	161.4	29.73
5	1651272	Q-2 Revmaster	Keller	393/2	134.8	31.17
6	1511226	Glasair	Hamilton	400/2	185.8	20.36
7	1472959	RV-4	Van Grunsven	400/2	175.6	20.96
8	1445499	Q-2 Rotorway	Komko	391/2	128.6	28.76
9	1097003	Mustang II	Beadle	331/2	163.5	20.28

EXPERIMENTAL CATEGORY: THREE OR MORE SEATS.

#	Score	Aircraft Type	Pilot	Payload /Seats	Speed	MPG

1	2680991	Long-EZ	Rutan	600/3	160.9	27.77
2	2510034	Rutan Defiant	Rutan	1200/6	176.9	11.82
3	2002316	Melmoth	Garrison	600/3	178.8	18.67
4	1269350	Turbo BD4	Phillips	557/4	150.4	15.16

ALL EXPERIMENTALS.

#	Score	Aircraft Type	Pilot	Payload /Seats	Speed	MPG.
1	2680991	Long-EZ	Rutan	600/3	160.9	27.77
2	2510034	Rutan Defiant	Rutan	1200/6	176.9	11.82
3	2217637	VariEze	Hertzler	400/2	137.6	40.29
4	2024503	VariEze	Lombard	400/2	154.4	32.77
5	2002316	Melmoth	Garrison	600/3	178.8	18.67
6	1919920	VariEze	Clark	368/2	167.2	31.24
7	1919121	Long-EZ	Melvill	400/2	161.4	29.73
8	1651272	Q-2 Revmaster	Keller	393/2	134.8	31.17
9	1511226	Glasair	Hamilton	400/2	185.8	20.36
10	1472959	RV-4	Van Grunsven	400/2	175.6	20.96
11	1445499	Q-2 Rotorway	Komko	391/2	128.6	28.76
12	1269350	Turbo BD-4	Phillips	557/4	150.4	15.16
13	1124428	Quickie	Hartman	156/1	110.1	65.40
14	1097003	Mustang II	Beadle	331/2	163.5	20.28
15	1013427	Quickie	Turner	187/1	106.1	51.17
16	767300	RV-3	Richter	200/1	173.4	22.13

OVERALL CAFE 400 PLACINGS USING THE 1981 CAFE 250 EQUATION

#	Aircraft	Pilot
1	VariEze	Hertzler
2	Long-EZ	Rutan
3	VariEze	Lombard
4	VariEze	Clark
5	Long-EZ	Melvill
6	Mooney 201	LoPresti
7	Quickie	Hartman
8	Q-2	Keller
9	Melmoth	Garrison
10	Glasair	Hamilton
11	Mooney 231	Minor
12	Quickie	Turner
13	RV-4	Van Grunsven
14	Debonair	Reese
15	Bonanza	Smith
16	Q-2	Komko
17	Defiant	Rutan
18	Mooney 231	Jewett
19	Twin Comanche	Bradshaw
20	Bonanza	Smith
21	Mustang II	Beadle

CAFE 400 OVERALL SCORES.

#	Score	Aircraft Type	Pilot	Payload /Seats	Speed	MPG.

Canard Pushers from 1 to 82

1	2768919	Mooney 201	LoPresti	851/5	164.2	19.82
2	2680991	Long-EZ	Rutan	600/3	160.9	27.77
3	2510034	Rutan Defiant	Rutan	1200/6	176.9	11.82
4	2477223	Bonanza A-36	Smith	1141/6	154.8	14.02
5	2217637	VariEze	Hertzler	400/2	137.6	40.29
6	2083655	Mooney 231	Minor	767/4	144.0	18.85
7	2052560	Beech Debonair	Reese	780/4	180.0	14.62
8	2024503	VariEze	Lombard	400/2	154.4	32.77
9	2018940	Twin Comanche	Bradshaw	936/5	181.6	11.88
10	2002316	Melmoth	Garrison	600/3	178.8	18.67
11	1968341	Piper Lance	Munir	1156/6	156.5	10.88
12	1919920	VariEze	Clark	368/2	167.2	31.24
13	1919121	Long-EZ	Melvill	400/2	161.4	29.73
14	1903088	Cessna 210	Hodges	1038/6	164.9	11.11
15	1842252	Cessna 310I	Keiter	1200/6	178.8	8.59
16	1780363	Piper Seneca	Parker	1196/7	172.8	8.61
17	1715613	Mooney 231	Jewett	668/4	151.4	16.95
18	1651272	Q-2 Revmaster	Keller	393/2	134.8	31.17
19	1559834	Bonanza V-35	Smith	665/6	206.7	11.34
20	1511226	Glasair	Hamilton	400/2	185.8	20.36
21	1472959	RV-4	Van Grunsven	400/2	175.6	20.96
22	1445499	Q-2 Rotorway	Komko	391/2	128.6	28.76
23	1429283	Cessna 182	Parmer	762/4	131.2	14.31
24	1418156	Piper Aerostar	Ballantyne	1064/6	185.6	7.19
25	1410479	Piper Archer	Powell	766/4	133.4	13.81
26	1394377	Partenavia P1	Slovak	975/6	157.7	9.07
27	1373327	Piper Aztec	Spongberg	1160/6	160.5	7.38
28	1365373	Comanche 180	Stuart	701/4	134.6	14.48
29	1356436	Cessna 310R	Reames	1000/5	151.8	8.93
30	1297926	Cessna 177-B	Hunt	677/4	133.5	14.35
31	1275115	Cessna 182RG	Peckham	800/4	156.3	10.20
32	1269350	Turbo BD-4	Phillips	557/4	150.4	15.16
33	1258616	Bonanza M-35	Thomas	601/4	167.9	12.49
34	1183163	Meyers 200D	Hallstrom	508/4	172.4	13.51
35	1171016	Rockwell 112	Workman	577/4	133.7	15.18
36	1165102	Cessna 177 Card.	Vlakancic	704/4	135.0	12.25
37	1124428	Quickie	Hartman	156/1	110.1	65.40
38	1097003	Mustang II	Beadle	331/2	163.5	20.28
39	1013427	Quickie	Turner	187/1	106.1	51.17
40	931356	Piper PA-20	Githens	624/4	110.8	13.47
41	870728	Bellanca 1419-2	Guymon	562/4	141.3	10.97
42	865417	Mooney 231	Morgan	521/4	154.5	10.75
43	862691	Apache	Von Waldegg	681/4	130.3	9.72
44	850964	Avcon Cessna	Newkirk	557/4	103.0	14.83
45	767300	RV-3	Richter	200/1	173.4	22.13
46	697400	Piper PA Pacer	Huffman	548/4	102.3	12.45
47	596625	Luscombe BE	Mathews	322/2	93.9	19.73

WATSONVILLE 1982
Sally and I flew N26MS into the Watsonville Flyin on Saturday May 30. The coast was socked in with typical low clouds, but we found a hole south of Salinas, and were pleasantly surprised to find ourselves alone in the pattern. Previous years, the Watsonville pattern has been much like Oshkosh first day. There were a lot of airplanes already parked on the flight line. After parking with the VariEzes, we counted 23 VariEzes and 2 Long-EZs on the line. We then nearly ate ourselves silly with giant sized strawberries and artichoke hearts while watching

a super airshow, a real Jenny doing loops, spins, etc. was unforgettable. Unfortunately, we had to be back that evening so we had to leave right after the airshow. We had a good tailwind and got back to our home base of Tehachapi (exactly 200 nm or 230 sm) in one hour flat!

Ams/Oil Rutan Racer
Dan Mortensen of Duluth recently broke the world speed record in the C-1-B Class for the National Aeronautics Association 3 kilometer course. He flew the Ams/Oil Rutan, a racing biplane owned by Ams/Oil. Mortensen recorded an average speed of 234.62 mph, breaking the old record of 227.24 mph set 16 years ago. At the 1982 Sun "N Fun EAA flyin in Lakeland, Florida, the Ams/Oil Racer won prominence of its own by being named the "Best Original Design".

Neal Johnson, Long-EZ builder #986, has worked up an excellent plans change/builder hints summary, itemized in Chapter order. It is well presented and covers CP 24 through CP 32. Neal plans to update this summary as required. This should prove to be a very handy aid to anyone building the Long-EZ. Contact:
Neal Johnson
P.O.Box 51
Monroe, LA 71201
Price is $7.50 to cover cost of postage.

VARIEZE HOSPITALITY FLYIN
Taos, New Mexico. What can you say about such a magnificent place? Twenty two VariEze's, two Long-EZ's and one VariViggen flew in to Taos, New Mexico on July 2nd and 3rd, with a total of 56 people. The weather was beautiful, cooler than usual. Charles and Joan Richey did a super job of organizing food, river trips, hiking and making everyone feel relaxed. By noon Saturday the whole crew had arrived and the "stories" started over lunch at the airport. How about one body being overheard on the radio asking "how do I run this gizmo, which button do I push now?" also a group, which shall remain nameless, getting lost and making a detour into Colorado!!! Up to the Condos to relax those tired flying muscles in the jacuzzi with beer, wine or Koolaid. The Condos are at 9,300 feet amongst the most beautiful pine and aspen trees with a stream running right by the front door. Steaks cooked on the barbecue came next, and more tall tales.

On Sunday, some folks slept in, others went on the river trip, some into town. Charlie, the gentleman who runs the condos, took the rest of us up the mountain to 11,500 feet in his four wheeler. You go up 2,200 feet in two and a half miles. We walked up to 12,000 feet to the most spectacular view ever, with wild flowers everywhere. We then braved it and walked down the mountain. More jacuzzi and supper in town. Monday morning saw everyone leaving and really wanting to stay. Thank you Charles and Joan Richey for making possible such a super weekend.

The following people drove or flew in:

Bruce and Bonnie Tifft	CA	115EZ	VE

Gary Hertzler	AZ	99VE	VE
John and Mary Jackson	MS	2VE	VE
Steve and JoAnne Sorenson	CA	118ST	VE
Dave and Marlene Werner	CO	8037T	VE
Mary Ann and Les Faus	CA	14533	VE
Mike and Pam Guthrie	CO	249MG	VE
Earl and Barbara Wilson	CA	999EB	VE
Mike DeHate	CA	322EZ	VE
Tom and Joan Nussbaum	TX	81TN	VE
Bob and Joan Hansen	CA	7LZ	LE
Joan and Charles Richey	NM	13EZ	VE
Shirl and Diane Dickey	UT	60SD	VE
Joe Lawyer	AZ	9039J	VE
Jo Alexander & Sheryl Summer	NM	257B	VE
Bill and Julie Lermer	CA	15820	VE
Ken Forrest	CA	84ST	VE
Roman & John Wasilewski	CA	24RW	VE
Bruce and Mary Muirhead	CO	?	VE
Bill Rutan & Micki Lanerty	UT	?	VE
Mike Melvill	CA	27MS	VV
Sally and Keith Melvill	CA	26MS	LE
Ken and Nancy Swain	CA	4ZZ	VE
Bruce and Sharon Tuttle	UT	?	VE
Will Thorn	MA	Cessna	310
Norm Sanford	CO	Cessna	182
Harry and Kathy Bawcom	AZ	Cessna	152
Ken and Mary Strong	CO	Cessna	182
Bill and Marilyn Schnieder	CO	Drove	
Ken Roebuck	NM	Drove	
Dave and Beverly Nelson	UT	Drove	
Jim and Jamie Morewood	UT	Drove	

Michael and I disagree on the number of VariEzes that are listed. He says that I have left someone off, but he is not sure who! Let me know if I have.

IVHC OSHKOSH BANQUET
Don't forget, this year the banquet will be held on Sunday, August 1st at 7:00 pm for cocktails and 8:00 pm for dinner. It will be held at Butch's Anchor Inn. Pay at the door. This banquet is open to anyone flying an EZ or members of the IVHC.

VariEze Help
William Rice is willing to show his VariEze and even give a back seat ride to any EZ builders in the northern California area. Bill has over 300 hours on N103B. Contact: Bill Rice, 1156 Ridgewood Drive, Eureka, CA 95501

A First Flight By Charlie Gray Of Florida
"Here I am at 35,000 ft. dead heading home from Boston to Miami on June 6th, 1982. Exactly 1 year 3 months after two kits arrived at my workshop, triple 5 Long-EZ made its first flight I cannot describe the sensation, in word form, as I pulled back on the stick and was airborne for the first time. It's just terrific - there were no trim changes required, it just flew and flew great. After once around the pattern and a smooth landing I taxied back for a kiss from my wife and hand shake from friends, I took off again for the second flight, this time for about one hour.

I was able to test low speed (59 mph) stall or nod and high speed about 170 mph at 1,500 ft. 87 degrees, 2850 rpm, for a true of about 177 mph. No spinner and pants. That's with 108 hp, 0-235-C2 engine and 25 lbs. in nose for center of first flight cg box. I even found some rain to fly through with no problem except small nose down pitch change. About 500 fpm, easy trim out.

It seems so inadequate to just say thanks - the superb plans, followed by CP newsletters and unbelievable builder support. The job being done by RAF is second to none in the home builder industry. It has been a joy to work on this project and I join with you all at RAF as a member of a very proud group of EZ flyers. We are looking forward to many happy hours of flying.
So Much Thanks,
Charlie Gray".

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LPC #102 MEO, Section I, page 21-4, step 6.
Strike the 5th, 6th and 7th sentences. Substitute the following: "Glass the inside with one ply of BID. Flox in place holding with nails. (Section F-F)".
Page 21-4, step 7. After "halfway down O.D.", insert "lapping 1" onto the forward face of the centersection spar".

VariEze and Long-EZ MEO
Owners Manual appendix three add "CAUTION friction in the pitch system can seriously degrade flying qualities". Also add ditching procedure shown on next page.

CP33, Page 4

EMERGENCY PROCEDURES
Ditching in water

Actual ditching has not been experienced to test the following procedure. However, this should provide the best chance for success. Wear your life jacket for overwater flying. On descent, bend safety catch away but do not open canopy. Extend the nose gear. Touchdown should be planned at minimum speed, landing into the wind. Land on the back side of a swell, or parallel to the swells. The aircraft or major components of the airframe should float and support occupants and equipment due to the large amounts of structural closed cell foam.

CAUTION! CONTROL SYSTEM FRICTION
The presence of friction in the pitch controls of an EZ will result in serious degradation in flying qualities. Mike recently installed a different shape canard tip and when reinstalling the elevators one of the pivot bolts was adjusted to bind an elevator. Sally and Mike both flew the aircraft with friction and reported PIO tendencies and over-control difficulty. Adjusting out the bind immediately returned the excellent pitch control and smooth flying qualities.

ACCIDENT - Inflight Airframe Failure
The thought of an airplane coming apart in the air brings chill to most aviators and certainly to aircraft designers. Despite many horror stories related to severe weather, drastic overspeed in dives, and even airframe flutter (unbalanced elevators), we had yet to hear of an inflight failure of a Rutan design - until June 21st when the caller described a winglet ripping off a VariEze at 200+ mph during an airport buzz job. Within two hours Mike Melvill and Dick Rutan were airborne in the Defiant for a non-stop flight to Dallas, Texas to investigate. What they found, though, did not lead to grounding or flight restriction of other VariEzes. The cause was tantamount to leaving the wing attach bolts off your Cessna and expecting the fairing strip to hold the wing on. Their report follows:

An aerobatic pilot witness standing nearby described what happened when the winglet came off. The aircraft yawed, rolled, and pitched up 90 degrees. The calculated 13-g loads did not fail the wings but twisted the fuselage enough to shed most of the plexiglass from the canopy frame. The aircraft impacted inverted on the prop and top cowling, then it slammed down, shearing the pilot's rollover structure, the top of the instrument panel and impacted the canard/fuselage fairing. It then bounced back into the air, rolled left to upright, and struck the ground upright,failing the main gear (pulled brackets and major glass structure from the fuselage). The aircraft came to rest 90 feet from the initial impact point at a heading of 110 degrees right of flight path. The nose gear was retracted. The right winglet was located

about 1,900 feet short of the wreckage. Parts of the plexiglass canopy were found 1,000 feet short. With the exception of the right winglet and rudder assembly, and parts of the plexiglass canopy, the wreckage was essentially complete and in one spot. Although it had sustained major damage, the airplane was located in a small area, not over 20' x 30'.

The right winglet failed inward during the high speed low pass. Sample sections were cut out of the winglet-root/wingtip. Skin coupons were burned out and the number of plies were counted. The type of glass and fiber orientation were determined.

Figure 1 shows the VariEze design structure and the structure found on the wreckage of N11CH. The major tension layup (#8) that was omitted was, without question, the primary weakness which allowed the winglet to fold inward and fail at high speed. The winglets lift inward and, at high speed (with zero sideslip) have an inward bending moment that is equal to that attained in a 15 degree sideslip at the maneuvering speed. Note that with layup #8 omitted, and with layup #9 not extending to the lower skin, the only structure opposing the bending was the foam core acting through rib #6 to the bottom skin. It is conservatively estimated that the structural strength of the winglet-to-wing joint of N11CH was less that 1/20 of what it should have been. It is very surprising that it did not fail sooner. The incredible thing that was not answered was how the builder could have omitted the primary structure and why it had not been noticed. Even after the final paint job, it was obvious that the #6 rib could be seen on the surface.

This aircraft throughout showed evidence of poor workmanship. Poor workmanship in itself had not precipitated structural failure with these construction materials. Prior to this accident the VariEze type had amassed approximately 150,000 hours flying without inflight airframe failure, even though many of the aircraft have relatively poor workmanship. The omission of important primary structure was clearly the cause of the structural failure.

SKETCHES OMITTED

CP33, Page 5

ANOTHER PROP INCIDENT

Ray Johnson from the San Francisco Bay area, flew his VariEze to Las Vegas, where it was parked in the desert sun for 5 days. He then took off and headed south at 12,500 feet. About 20 miles north of Apple Valley airport, a horrendous vibration set in. Ray throttled back, pulled the mixture to idle cut off and pulled the nose up to slow down. When the engine stopped turning, the vibration went away. Ray glided in to a landing at Apple Valley. Other than the Cessna that pulled out in from of Ray on final, causing him to have to land off to one side of the runway, it was uneventful. Ray's prop was still on the airplane, 5 bolts had sheared, one was bent but still holding and the spinner retained the prop.

This is a classic case of flying from a moist ocean climate to a dry desert climate. The wood prop shrinks just a little bit, the bolts no

longer have the correct torque, so the prop starts to move and in literally seconds, the bolt holes and drive lug holes become elongated, and the bolts break off at the drive lug due to fatigue.

Check your prop torque, it should be between 18 ft/lbs. (216 inch/lbs) and 20 ft/lbs. (240 inch/lbs). With a new prop, you should check the torque after one flight. Then again after 10 hours, then at 25 hours, and thereafter every 25 hours.

NOSE WHEEL SHIMMY/FAILURE

We have heard of three more nose wheel fork failures. This is a part of our airplanes we seldom see; it is retracted when parked and we are usually in the seat when the gear is extended. Do not neglect to check you nose wheel during your preflight. Pay particular attention to the friction damper. You should grab the tire as far aft as possible and swing the fork left and right. It should take 2 to 4 lbs. of force to do this. If you are not certain how much 2 to 4 lbs. is, use a spring scale to calibrate yourself. If you have less than 2 lbs., it is possible for the nose wheel to shimmy. This shimmy or flutter instantly goes divergent and in only a fraction of a second the fork will fail, due to side loads. The nose wheel/fork, can bounce back and go through the prop. The nose wheel fork is designed with more than enough integrity to take the maximum expected landing loads and has been tested to over 80% above the FAR Part #23 requirement without failure (see CP #18). This type of failure caused by shimmy generally occurs with very little load on the nose wheel, usually at the very moment of a nose wheel touch down, or even at the moment of nose wheel lift off during a take off. The new shimmy damper spring called out in CP 30, page 4 MUST be installed and correctly adjusted. Also check to see you have no ovalizing or bending of the NG17 steel tube and that the thick-wall (0.125+ wall) NG17 is installed.

LONG-EZ PROPELLER UPDATE

We have been testing a few different props on the Long-EZ, and we are finding the best all round performance for the 0-235 Lycoming to be a 62" dia. x 66" pitch. This is a larger diameter than the maximum diameter called out on the back page of the plans, however, we have several hundred hours on two of these props, on N79RA and N26MS and we have not encountered any problems. These props are available with the urethane "rain proof" leading edge from the following two companies:

Ted's Custom Props	B & T Props
9917 Airport Way	8746 Ventura Avenue
Snohomish, WA 98290	Ventura, CA 93001
(206)568-6792	(805)649-2721

We have had one each of these props on test for over a year, and both perform flawlessly and are very close in performance. Be sure to get your prop order in at least three months prior to your estimated first flight date. Don't let yourself be caught with a finished airplane and no prop to fly with.

BUILDER HINTS

Terry Crow suggests an insulated box to keep your epoxy pump and epoxy warm. Build it out of styrofoam. (bead board ok). Glue it together with epoxy, make hinges out of BID, epoxy them on. Leave them dry at the hinge line. Terry keeps his at 85 degrees + or - 3 degrees with a

cheap fish tank heater in a plastic bottle filled with water. Parts cost $8.00 and one hour of time. Terry also suggests that if you have not used your pump for a week or more that you discard the first squirt, as the ratio can be off.

Christopher Brichamban suggests you try sticking a 1/4" wide strip of masking tape along the cut lines on your BID. Cut down the center of the 1/4' wide masking tape, carry it to the plane and lay it up. The masking tape comes off quite easily and this allows you to maintain the shape of the BID between the cutting table and the plane.

Dan Wicklund says a 20 gallon styrofoam ice chest (24" x 14" x 14") makes a great storage area for keeping resin, hardner etc. at 85 degrees. Use a 40 watt light bulb and a dimmer switch, run the chord through the drain hole and set the whole works on 2 scrap 2x4s to keep it up off the floor.

Nat Puffer suggests a good place for a DME or transponder antenna is in the leading edge of the wing root. Simply hollow the wing leading edge out a little deeper, see Page 19-13, Section F-F. Do this similar to Section E-E on Page 19-14, and mount the antenna in the void.

Installation of side consoles. Make all of the side consoles and fit them, but do not install them at this time. Install all the fuel lines, wiring, rudder cable conduits, relief tubes, the control system in it's entirety, the landing brake and the pitch trim system, before you glue the side consoles in permanently.

VariEze Comm Antenna
This has been an ongoing problem, and several different antennas have been tried, some have been successful, but not on every airplane. The comm antenna on a Long-EZ is in the vertical winglet. Unfortunately the winglets on a VariEze are just not big enough. Mike DeHate has an excellent radio. We recently talked to him from over 100 nm away and he sounded as though he was on our wing. He has the following antenna: He cut an ordinary piece of house wiring to 20 1/4" long, and pulled two strands of copper wire out of this piece. These were inserted into a conduit which was installed on the trailing edge of the main gear. The center conductor of the RG58AU coax cable is soldered to the 20 1/4" length of copper wire that goes down the gear leg. The shield is soldered to the 20 1/4" length of copper wire that goes through the fuselage. Three ferrite beads are installed over the conduit per the sketch below. The beauty of this arrangement is that if it should break it is easy to pull out and replace. **SKETCH OMITTED**

Moldless vs Prefab shells for Homebuilt Construction.
We often get requests to provide molded shells of the Long-EZ to make it "easier to build". Our experience with molded shells has indicated that the full-core moldless structures provide more reliable structures without compromising building time. The most meaningful demonstration of this though, is actual homebuilder experience. Johnny Murphy, who has built four different moldless aircraft, recently completed a molded Glasair. His comments on relative simplicity are printed in the Spring '82 issue of Sportsman Pilot magazine. Sportsman Pilot is a quarterly with very quick response publishing of current homebuilt news. Each issue has a wealth of the latest happenings in the experimental world. Subscriptions are $7.50 a year, Box 485, Hales Corners, WI 53130.

SHOPPING

Engines:

Norm Bender
Box 30343
Memphis, TN 38130
(901)794-0032
Contact Norm for Long-EZ 0-235-L2C, new or factory remanufactured engines. Norm says that a Lycoming price increase is imminent!

Dick Waters
1325 W. Washington St.
Orlando, Fl 32805
(305)422-0188
Dick has rear cases to bolt on Cessna 152 engines that will accommodate mechanical fuel pumps and oil cooler. These cases are available outright or exchange.

Memphis Aircraft Power Services,
3734 Winchester Road,
International Airport, Hanger #5,
Memphis, TN 38116
901-345-2850
Bob Norville, has several O-235-L2C engines.

David Hoffman Products
1009 Old Mill Road
Auburn, AL 36830
(205)821-8942
Dave has very light weight cockpit lights for $12.50 each. Includes postage, or these lights can be bought from Aircraft Spruce, same price.

Bob Arthur,
23718 Soresina,
Laguna Hills, CA 92653
213-922-2078 (Work)
714-837-4071 (Home)
VariEze main gear and nose gear struts. Bob also has other VariEze parts.

C. Willwerth,
215 Froman Drive,
Summerville, SC 29483
VariEze original main gear strut, sell or trade for Long-EZ main gear.

Phil Supan,
1401 Market Street,
Santa Clara, CA 95050
Phil has a limited number of switches suitable for the warning system in a VariEze or Long-EZ. Phil will send them out post paid for $1.00 each.

WANTED:

Pre-fab fuel tanks for VariEze.
Contact: T.W. Tyner,
Box 11625
Houston, TX 77293
713-695-9262 (Work)
713-446-5720 (Home)

O'Products, manufacturer of engine protective plug kits for Beech and Piper, are now offering similar kits for the homebuilder. Kits are presently available for the Long-EZ and can be custom made for the VariEze Long-EZ kits for aircraft either with or without a prop extension are being produced. They may also be ordered for either the "male" or "female" inlets. The 'A' kit (for aircraft with 3" prop extension) is priced at $85.95 and includes three plugs and storage bag. The 'B' kit (for aircraft with 6" prop extension) is priced at $124.95 and includes five plugs and storage bag. The storage bag fits snugly into the space behind the passenger's head and is available separately for $24.95 in red, blue and yellow Naugahyde. Add $10.00 to kit or bag price for special color bag. For further information, or to order contact:

Patrick O'Brien
O'Products Homebuilt Division
269 Marjori Avenue
Thousand Oaks, CA 91320
(805)499-7369

Aircraft Spruce is now stocking the AOA oil analysis kits for $8.95. The David Hoffman cockpit lights are in stock for $12.50 each. They are changing to Latex gloves instead of vinyl, same price and they will also be stocking cotton liner for the Latex gloves.

VARIVIGGEN NEWS
As promised in the last newsletter, all those who requested to be put on a list to talk to and help other Viggen builders, should by now have a copy of the list. Any other builders who would like to have their name, address and phone number put on the list, let us know. The list will only be mailed to those who are on the list. The sole purpose of this list is for mutual aid, both moral and technical among the Viggen builders.

Ken Winter who had his Viggen at Oshkosh last year in gray primer has been working hard getting it completely finished for this year. It is really looking fabulous, as Ken and Kay have really put a paint job on it. In Kay's words "it gives our Viggen a commanding appearance". Look for this beauty at Oshkosh '82.

Len Dobson is planning on being at Oshkosh, so we should have at least 3 on the flight line. Unfortunately Bernard Duneman had a gear failure. The left main gear folded up after a normal landing, and Bernard is now having to do some fairly major repairs. It is not certain if he will make Oshkosh.

Bernard's failure was caused by the MG4 beam collapsing and allowing the gear to fold. It turns out that the Brock-supplied MG4s were fabricated out of 1018 steel, and this material is too soft. This is what was called out to Brock and at the time it was thought that 1018 would be more than sufficient, however, based on what happened to Bernard as well as Len Dobson, we feel that the MG4s should be fabricated from 4130N steel, and heat treated to 150,000 psi. The MG4 on my Viggen N27MS are fabricated from 4130 and heat treated and with 530 plus hours, and over 600 landings there has not been any problem. In view of the above, we are recommending that any builder or flyer who has the Brock fabricated MG4s, should contact Brock and exchange the original 1018 steel MG4s for 4130 heat treated parts. This is a mandatory change and must be complied with before next flight.

N27MS flew to the Taos Hospitality Club Flyin, a distance of 636 nm (732sm), with Sally flying our Long-EZ in loose formation. Our true airspeed at 11,500 ft was 138 kts (159 mph) and the Viggen (180 hp Lyc.) burned 7.8 gph. Our ground speed going east was 150 kts. (173 mph) and coming back, fluctuated between 109 kts (123 mph) and 131 kts (150 mph). I was happy with the Viggen's high density altitude performance, we landed at Flagstaff, AZ (7000 ft elevation), Taos NM (7100 ft elevation) and Winslow, AZ (5000 ft elevation) and had no problems. I was solo in the airplane; had I been two place, I would have been more concerned. Any aircraft is affected by density altitude. My technique is to lean for best power and lift the nose wheel as soon as possible, then hold an attitude that keeps the nose wheel off and accelerate on the mains to about 90/95 kts. or at least 5 kts above best rate of climb speed. Then I pull it off and climb to at least 100 feet before retracting the gear. The gear is draggiest in transit and I find I lose most of my 5 knot excess speed and even a little altitude during the time that the gear is in transit. Of course, this only applies to high density altitude operations; the airplane is very normal at sea level and climbs quite rapidly. The SP wing makes a big difference and anyone planning to do most of their flying at high altitude airports, should seriously consider the SP wing.

Propellers: N27MS seems to perform best all around with a Ted's 69 x 69. This gives reasonable cruise, and still allows a good rate of climb. I also have a Ted's 70 x 70, which works well at sea level or thereabouts, but it is not a good choice to fly in and out of airports like Flagstaff, Aspen, Taos etc.

Viggen Plans Changes.
MAN-GRD. MG4 beams, fabricated by Brock must be replaced by 4130 steel heated treated parts.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Solitaire joined up in formation under power (above) and soaring with the prop folded away (below). Mike reports that formation flying is actually easier without power, using the spoil-flaps for speed control.

Solitaire Cockpit.

The Solitaire nose - note the coincident fuselage nose and canard leading edge - an arrangement that eliminates interference drag.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

EZ's can be built in a living room if you have a "perfect marriage and a window in the right place". Chick Tonelis.

Space Shuttle launch from two different EZs.

The lineup of Canard-Pushers at the VariEze Hospitality Club's Taos, New Mexico, Flyin.

An informal static load test of a reject canard loaded at the Miami seminar. Sixteen men wrestle for room while Mike measures the buttline of everyone's feet! A non-catastrophic failure occurred near a hinge fitting at about 11.5-g.

Snug as a bug in a Grizzly. Sally, Pat and Teddy check out the Griz sleeping area.

CHART OF HOMEBUILT AIRCRAFT PERFORMANCE - CAFE 400 OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Three relatively new faces at RAF. Right to left, Michael Dilley, Larry Lombard and Doug Shane. RAF has recently grown in number, but most will move to the new SCALED COMPOSITES company when the facility is completed this winter.

A Long and a batch of EZs provide a contrast to the Biplanes at the EAA Watsonville flyin.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.1ft
Area	94.8 sq. ft.
Empty Basic	750 lb.
Empty Equipped	800 lb.
Solo Weight	1000 lb
Gross Weight	1425 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	600/950 ft
Climb (solo/gross)	1750/1250 fpm
Cruise 75% 8000 ft	186 mph

Cruise 40% 12000 ft	146 mph
Top Speed - Sea Level	193 mph
Max range * 75% (solo/2 place)	1380/1150 mi
Max range * 40% (solo/2 place)	2070/1690 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 full size drawings. It includes many photos, over 800 drawings and 65,000 words. The builder is led step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components. A video tape is available covering all aspects of building the moldless fiberglass/foam sandwich construction. The tape covers the latest methods used to obtain the optimum weight, strongest fiberglass lay ups. This presentation will help both the first-time and experienced builder and attain quality aircraft workmanship.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction for the complete engine installation, including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

A video tape is also available which covers the weight and balance procedures, taxi tests and first flight.

LANDING BRAKE - Complete full size drawings for the landing brake device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

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Section IIL Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00

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Newsletter not taxable.

The following are RAF-authorized distributors of Long-EZ materials and components. Contact the distributors at the addresses below for their and description of items.

ALL RAW MATERIALS AND PREFAB FIBERGLASS PARTS

Near Los Angeles
AIRCRAFT SPRUCE
201 W. Truslow, Box 424
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Catalog $4

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Highland, IL 62249
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Prefab machine parts such as, control system parts and welded parts, fuel caps, engine mount, rudder pedals and exhaust systems.
KEN BROCK MANUFACTURING
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Stanton, CA 90680
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TASK RESEARCH INC.
848 East Santa Maria
Santa Paula, CA 93060
(805) 525-4545

Canopies are available from RUTAN AIRCRAFT.

RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

RAF has recently had noted artist Jim Newman draw a complete illustrated cutaway of the Long-EZ. The result is not only a fine frameable work of art, but is also a technically accurate reference. Lithographs of this drawing in 20" x 30" size may be available at Oshkosh. Price is $10.00 which includes postage.
DRAWING OMITTED

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 34. If you are building from 2nd Edition plans you must have newsletters 18 through 34. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 34. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 34. If you are building a Long-EZ you must have newsletters from 24 through 34.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes.
Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 on Saturday. Closed Sunday.
If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
RAF has undergone several changes since Canard Pusher #33. Burt's new company Scaled Composites Inc. is officially off and running. Scaled's new building is going up rapidly next door to RAF. Roger Houghton and Doug Shane have both joined Scaled and Larry Lombard has moved to Task Research in Santa Paula.

This has left RAF with Burt, Mike and Sally, Trish Palmer and Michael Dilley, Michael Dilley was heavily involved in the construction of the Amsoil Racer. He is also an expert prop carver and is proving to be a very valuable asset. Both Michaels are presently hard at work drawing Solitaire plans. RAF is shooting for a target date of January 1983,

when we hope to have the Solitaire plans available. Prefab parts will be developed and should be ready about the same time. In between, development continues in the Solitaire's engine department. We have just installed our third engine, this one is a KFM 107E and it looks promising.

RAF has agreed to join with Voyager aircraft (Dick and Jeana) to build the Voyager. Work is currently underway. This will be an interesting project due to the very latest state-of-the-art technology being used. Voyager will be built at RAF and should be flying in the summer of 1983.

We are also developing a new, steerable nosewheel (fork and lower casting) which will be retrofittable to both VariEzes and Long-EZs. This project is in the early stages of development, so please don't call us for information. When it is successfully developed and flight tested it will be available from Ken Brock, perhaps around Christmas time.

Soaring Society Of America Homebuilt Contest
The final stage of the contest was held over the Labor Day weekend in Tehachapi, California. This was most convenient for RAF, since Mojave is only about 20 miles east of Tehachapi which allowed us to make an airborne arrival. Burt flew the Grizzly towing Mike in the Solitaire from Mojave, west over the mountains where Mike released and did a little soaring while Burt descended and landed at Fantasy Haven. Mike then flew a short arrival show including hammerhead stalls and loops before landing.

The Solitaire was very well received and closely examined by the large crowd on hand. We removed a wing to allow the judges to see how it was done. Two of the judges flew the Solitaire which was towed as a pure sailplane behind the Grizzly. The two judges, Einer Einervoldson and Walt Mooney flew the Solitaire in formation with a Schweizer 1-36 (a 31:1 L/D) and the Solitaire was faster and did not loose altitude as quickly.

On Sunday morning the judges' decision was announced. The Solitaire was declared the winner by unanimous vote.

During the three day weekend, the Solitaire was flown many times, self launching using the Normalaire Garrett two cylinder engine and by being towed both by the Grizzly and the Pawnee. After the contest, Mike self launched the Solitaire and flew back to Mojave. We have flown almost 50 hours in 78 flights. The longest flight was self launched, the engine then shut off and thermalled for two hours and 21 minutes. Eight pilots have flown the Solitaire at this time.

RAF-Developed Composites Fly In The NASA Space Shuttle
The structural components in the Utah State University "Getaway Special Package" (a student project) flew on the latest NASA Space Shuttle mission using the basic RAF composite construction methods almost exclusively. Long-EZ plans, Chapter 3 was the text used. RAF is proud to have helped the USU student package become the first and only package to be completed, accepted and flown.

Congratulations to Don Jones of Knoxville, Tennessee. Don's beautiful VariEze was selected to receive the Wright Brothers Award at the 1982 Dayton International Airshow and Trade Exposition. Don's VariEze also won an award at Oshkosh 1982 for Outstanding Workmanship. It really is an excellent example and Don deserves these prestigious awards.

OSHKOSH 1982
RAF was well represented this year at Oshkosh. Burt and Pat flew the Defiant via Salt Lake City and Wichita. Dick flew his Long-EZ and Jeana flew Mike's VariViggen. Michael Dilley and Doug Shane drove the van pulling a trailer with the Solitaire on board. Mike flew the Grizzly and Sally their Long-EZ. This was interesting as Mike trued out at about 107 knots and burned 10 gph, and Sally in the Long burned 3.6 gph, and that included occasionally flying circles around the Grizzly (literally!). Everyone arrived safely at Oshkosh, although this year we all had to skirt around and under low ceilings and rain.

There was an impressive display of Rutan aircraft featuring; 16 Long-EZs, 64 VariEzes, 2 VariViggens, 1 Defiant, 1 Grizzly, 1 Solitaire, 1 Cozy, 1 Gemini and 1 Amsoil Racer. This year was the first time for the Grizzly, Solitaire, Amsoil Racer, Cozy and Gemini. Cozy and Gemini are privately built derivatives using the flying surfaces of the Long-EZ. In addition to all of this, the scissor wing AD-1 from NASA was there. The AD-1 of course, was designed by Burt in 1977 and was the result of an unsolicited proposal to NASA by Burt in 1975. The AD-1 was flown every evening in the airshow by NASA test pilot Tom McMurtry.

The Grizzly and the Solitaire were flown in the fly bys and the afternoon airshows. The Solitaire flew under its own power and was towed by the Grizzly as a pure sailplane demonstrating its 32:1 L/D for the first time at an airport other than Mojave.

One of the highlights of the convention for RAF, was the gathering of all of Burt Rutan designs for a photo session in front of the announcer's stand. Eleven different aircraft types were parked in a loose circle around the NASA AD-1, while press photographers snapped hundreds of pictures. (see back page). **PHOTOGRAPH OMITTED**

After the incredible Oshkosh week was over, all the RAF folk pressed on home. The only change being that Burt traded with Mike and flew the Grizzly home, stopping at several small grass strips. Several times, while flying into the teeth of a 20 knot headwind, Burt was heard to mutter something about wanting his Defiant back! The annual trek to and from Oshkosh every year is a major undertaking for RAF and although it is always fun, it is also very tiring. It was good to be home and all had a safe journey.

The following EZ Flyers flew into Oshkosh '82. Our thanks to all of them for making it such a successful show. "Mom" Rutan pleads once again for photos of your aircraft for her book. She says "many thanks to all who have sent photos in, but I'm still missing a few!"

VariEzes

Canard Pushers from 1 to 82

Baker	N14EZ	CA	Kapperman	N16EL	CA
Curtis	N778CB	TN	Langerud	N91CL	TX
Benjamin	N40EZ	PA	Larson	N18VE	CO
Hirsch	N203DB	IL	Lawyer	N9039J	AZ
Boos	N41EB	IL	Lee	N35EZ	CA
Boyer	N95EZ	PA	Loewen	N80WL	CA
Brokaw	N224DC	MI	Lonsway	N15RL	FL
Butters	N235LB	MO	MacDonald	N13JF	PA
Coltharp	N40LC	OK	Mason	N27GM	MI
Cutler	N46RC	PA	Maricer	N22ZC	NM
Day	N999JD	CA	Marsh	N404EZ	CA
Dickey	N60SD	UT	McKean	N57EZ	TX
Dunn	N42CD	KS	Mondary	N500EZ	IN
Ellis	N547EZ	OH	Monnia	N81TM	OH
Fay	N23FF	CA	Patch	N862DP	CA
Fehling	N444EZ	FL	Pavolich	N810TC	WI
Ferguson	N2286A	NC	Povlton	N79CP	OH
Foster	N77LF	CA	Rossignol	N23NR	CT
Fowler	N82JF	IO	Rutledge	N28RR	IL
Friling	N28JF	IL	Sorenson	N118SJ	CA
Gardner	N13WM	CA	Stockton	N51WC	KS
Gehres	N56EZ	FL	Swain	N2ZZ	CA
Geisler	N95F	MT	Seibel	N101MW	IL
Good	N66EZ	CO	Seibold	N6VE	AZ
Grove	N82GR	CA	Snyder	N412EZ	IN
Hazelrigg	N67EZ	IL	Stewart	N429T	IL
Hertzler	N99VE	AZ	Tifft	N115EZ	CA
Himmerich	N25RH	IL	Thornhill	N3252	TX
Hoagland	N1335D	IL	Brombino	N46JT	IL
Hoepfinger	N7AH	IN	Walker	N419JW	FL
Hornbeck	N76PG	MO	Wilson	N999EB	CA
Jones	N300DJ	TN	Williams	N17DR	MO
			Yoakam	N770DY	FL

Long-EZs

Adrien	N46AA	MA	Rutan	N169SH	CA
Burks	N102LE	CA	Sanders	N81HM	TN
Collins	N197GC	GA	Sheffels	N6825	MT
Wallace	N711QA	CA	McElroy	N80DZ	WA
Gruber	N401EZ	IN	Melvill	N26MS	CA
Hanson	N7EZ	CA	Norris	N555PN	OH
Hunter	N14LZ	FL	Van Noord	N7VN	CA
Rodewald	N1344T	HI	Williams	N95JV	MN

VariViggen

Melvill	N27MS	CA
Winters	N31WW	OK

Rutan	Defiant	CA	Ganzer	Gemini	CA
RAF	Grizzly	CA	Puffer	Cozy	MN
RAF	Solitaire	CA			

Kerrville, Texas Flyin
If you want to enjoy an easy going, no rush flyin, Kerrville is a must.
Mike and Sally flew N26MS with Bruce and Bonnie Tifft in the yellow

bird from a join up over Big Bear, California to Kerrville, Texas in seven hours. We made one stop in Lordsburg, New Mexico. Usually a gas/pit stop is uneventful but not this time. Bruce landed behind N26MS and as we were taxiing in, Bruce calls on the unicom "Lost my front wheel". Into action comes the VariEze Hospitality Club. Mike climbed back into N26MS and flew to Los Cruces and borrowed the front fork straight off Charles and Joan Richey's VariEze!! Within an hour we were in the air.

Kerrville is in the rolling hills of Texas with a quite large river running through town. There were about 16 VariEzes and Long-EZs. Friday night the EZ people got together for supper and the "tall tales"!! On Saturday evening the EAA Chapters gave a really super banquet. Before the airshow started on Sunday 6 VariEzes and 2 Long-EZs took off and flew a loose formation flyby. It was a most enjoyable flyin, very relaxed with just great Texas hospitality.

International VariEze Hospitality Club By Don Shupe
The club was founded several years ago to encourage and promote hospitality, travel and support by people interested in VariEzes and composites in general. We publish a quarterly newsletter that contains a list of members that is updated on a yearly basis with quarterly supplements. We publish the letters we receive from members and try to provide the latest information available on flyins, published info of interest and survey data that we collect at flyins. Members are expected to provide shelter and comforts to other members in need according to the hosting members ability to provide these courtesies at any given time. Courtesy demands that members give expected hosts as much advance notice of the intent to visit as possible. The most common complaint we get from members is that they do not get visited frequently enough.

We sponsor flyins several times a year at various locations around the country as a function of member interest and availability of members who are willing to do the organizational work required. The complexity of the flyins varies from the highly organized extravaganza produced by the Richeys of Las Cruces, NM at Taos to the more informal "do it yourself" flyin at Loreto, Baja. Members seem to like the flyins and attend in large numbers if the weather is good and advance notice is sufficient.

By support, we mean that if possible we fly parts and repair equipment to members that are stranded anywhere in the world where we have members. We have delivered props to people who have had to make emergency landings and had them back in the air in less than four hours. Members who have been helped are expected to pay the costs of the help they have received but nothing else is expected of them. Many members have used this service which is especially comforting when you are traveling in country far from home where you don't know anyone except the names on your membership list.

If the preceding describes an organization that seems to fit your needs and interests, contact IVHC, 2531 College Lane, LaVerne, CA 91750. Enclose a check for $6.00 state side and $8.00 overseas membership.

Long-EZ Squadron I

This is a Long-EZ builder/flyer club. Anyone with Long-EZ plans or building a Long-EZ in the Los Angeles basin area is welcome to write to the address below for information on the club and its purposes. This club is not for people with a general interest, but is for serious builders and only Long-EZ builders. The club is very well run and has meetings once a month. They put out a monthly newsletter to the 48 paid up members. There are organized committees to assist builders in various areas such as electrical, engine installation, structure and even plan interpretation. The club tries to have interesting speakers at their meetings and members are encouraged to bring parts to the meetings for constructive criticism. There are two Long-EZ's completed and flying and two others that are close. This group is builder support oriented. There is little or no social aspect.
Contact: Long-EZ Squadron I
7000 Merrel,
Chino Airport, CA 91710

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LUCKY YOU FLY THE LONG-EZ

Would you like to take your Long-EZ from Honolulu to Oshkosh? And if you can get it together, go the 4,500 miles non-stop? I started planning on day one. The first cloth was cut 12 March 1981 and Oshkosh 82 looked like an easy goal. "Coffin Corner" goals in homebuilding are not recommended as they can unwind your main spring and money supply.

Long-EZ construction went along very easily. This was my third composite homebuilt. The first flight was on 7 June 1982. Oshkosh looked easy, but wait: The Loran wasn't working yet, neither was the ADF, nor the Compucruise, nor the SSB radio. It looked like the NAVCOM was inadequate for IFR. The new transponder was dead and 1344T needed 40 hours faster. It was flying great so I filled the tanks and by 16 June I took 1344T to the EAA Big Island Chapter 780 meeting with the first 40 hours flown off. It was looking good, but wait: The Compucruise had been calibrated, however the Loran wouldn't work with it on. With the Compucruise off, the ADF was only 20% effective and the Loran still wouldn't work. The core of the problem is that it's a fiber glass airplane and has no ground plane or counterpoise and none of the normal metal shielding found in aluminum airplanes. Add dirty power to this and the dirtiest electrical noise of all, the Compucruise, and a lot of time can be spent solving the noise problem. Actually once I got a system of detection, isolation and elimination going it was okay, however this cost me almost 30 days of down time. It can be done in less. Here's how I did it. Note: if you do not need any low frequency COM or NAV gear, you may disregard all of this and simply live with the noise as VHF is high enough not to be affected.

I started by disconnecting everything: battery, voltage regulator, alternator, p-leads at the engine, and all radios and appliances. I then used a small inexpensive transistor radio and tuned off a station. I started the engine many times checking for electrical noise using the transistor radio to ferret out each source, following up and down the wires inside both cockpits, into the engine bay and all over.

Here's what I went through. I replaced the mag switches as they were poor quality and arcing inside. I replaced the Kubota tractor alternator as it was noisy and short on output. I had to add a torroidal type coil and 2 capacitors to the Compucruise airspeed gizmo to quiet the oscillator and then seal the box with copper tape to keep the residuals inside. I then disassembled both mags and found a coil shorting in one. Then I removed the suppressors, because I didn't need them. The sneakiest noise of all was the voltage regulator. It sounded like ignition noise. This wasted a couple of days because my detection system broke down. I just couldn't believe it wasn't an ignition harness problem. The Prestolite transistorized regulator needed a coil and 2 capacitors which quieted it about 85%. It was never perfect. The Prestolite alternator had a whine that ordinary suppressors wouldn't quiet. I added 2 of the largest hash chokes available, which together with 2 capacitors and a lot of trial and error finally gave me fairly quiet power.

Back to the cockpit. Early in construction, before glassing, the single side band (SSB) HF antenna was run from the top tip of each winglet down the leading edge of the wings, wing strakes and around the nose. I installed a switcher so that the Loran could share the antenna except when transmitting on SSB. Sharing this antenna didn't work. Loran is too sensitive to noise and I still had a low level of noise. The Loran antenna placement problem eluded me until just a couple of days before departure. It was refusing to work in a fiberglass airplane. I had tried everything and was about to give up when it came to me. I dug a hole in the lower left winglet and put the Loran antenna pre-amp inside. I then ran a coaxial lead to the set and used 10 feet of .020 stainless wire with a small sinker out the aft of the lower winglet (trailing wire antenna). A quick test hop confirmed that the Loran was now working better than it ever had in the shop. I had essentially removed the Loran antenna as far as possible from all noise. The ADF required a lot of trial and error with the sense antenna. The best solution was a piece of copper foil tape from the nose up to the canopy rail and aft along the rail to the rear bulkhead. It was little short so I looped it up and over the head rest. Wrong. I wasted about a day of trial and error to figure out that I was too close to the voltage regulator with this antenna and had to keep shortening the length until I got it. The ADF now worked, but less than satisfactorily. It worked to Oshkosh, but prior to the Oakland-Honolulu return leg it quit, consumed a 200 dollar bill and worked much better. A prudent navigator always has a backup and on the return leg it was worth every cent of the repair. Let's flash back to getting ready.

Mid-July and I was still searching for an adequate bladder tank for the rear seat. It was an impossible search so I started foam and fiberglass auxiliary tanks Wow! This took a week. The front tank held 25 gallons, the rear 57. Luckily the plumbing and vent system was already in and approved. The auxiliary tank system test flight was go.

I haven't mentioned the Compucruise because it defied all efforts to quiet the noise. I simply turned it off to use the low frequency navigation or COM gear. This requires turning the Compucruise off and reprogramming it for use when you need it.

Shielding is a big part of noise control when going beyond a NAV/COM. I used shielded wire in the main power and regulating system and used it generously anywhere I suspected noise would be generated and transmitted in the wire bundle. Hindsight says I should have considered putting the wire bundle in an aluminum tube.

There were only two days left to departure. The NASA packet autopilot was almost ready. Before proceeding, the electrical noise was checked and flunked so I abandoned that effort. There wasn't time anyway.

The total effort was not without a lot of help. I never could have been ready without Sherry Emminger doing all the flight planning; Richard Emminger on weather; Sandy Moats on auxiliary tanks; Ann, my daughter, on programming the Loran and Rollie Moran and Jon Michelle on electrical problems. My wife Rosemary, bless her soul, ran the myriad of last minute errands.

The day before launch I still had to weigh the total loaded aircraft and work a weight and balance. It had weighed 755 pounds night IFR equipped and now weighed 1814 pounds with 137 gallons of fuel, me, the Loran, ADF, SSB, life raft, mae west, survival gear, candy, sandwiches and water. The weight and balance was dead center in the first flight box.

I told Sherry to plug in the 7 knot tailwind forecast over the Pacific and that I would work out the winds over the mainland when I got there. I went to bed at 1500 hours. Launch was scheduled for 0430 and I slept until 0400.

On the advice of a NASA flight surgeon, I wore a set of full length anti-embolism stockings and in addition, took an aspirin a day for a week prior to the flight to prevent clotting. Other than that, the only personal preparation was to wear warm loose clothing. Of special help was a down vest with removable, velcro attachable sleeves made by my daughter, Jill.

A last check of wind and weather showed no change so I started the last minute countdown. It didn't go too smoothly and I was an hour fifteen late on launch.

The Loran gave good track information and I split the Golden Gate, however, because of the Loran ground station layout and the fact that I went Loran station to Loran station (Honolulu to Fallon), crosstrack was sketchy and primarily DR. I had a couple of big shocks over the water. The first was 15+48, which was the over water flight planned flight time. There was no West Coast. Obviously the wind wasn't as planned. There was no VOR and no ADF information. Only the Loran said I was on course, so all I could do was keep trucking. Two hours later the shock sort of wore off. The moon had come up and gone down. Wow! It was dark and lonely out there by myself. The engine quit!! I changed from auxiliary to wing tanks very quickly and it started right up. I was two hours overdue on the flight plan to the West Coast and only had 12 hours of fuel left. How lucky I really was would not be realized for another two hours. It was almost 4 hours over flight plan before the over water portion ended. Almost any other

airplane in this class would have gone down in the water. "Lucky you fly the Long-EZ".

I had picked up a 14 knot head wind versus the 7 knot tail wind forecast. It didn't take a lot of calculation to figure out what to do. It was quite obvious that it wouldn't go to Oshkosh as planned. So rather than cross the Rockies at night and then have to land in Nebraska, I stopped in Sacramento.

The next morning I went to prop the Long-EZ to depart for Oshkosh and discovered a piece missing from the prop. I called Bruce Tifft at Oshkosh for consultation. He said to take a like piece from the other blade and try it for balance. I filed the piece out (3" x 3/8") and gave them both a little varnish. It ran up okay so I launched for Oshkosh. The winds from RNO to STL were the first tail winds I'd had, but they shut off at STL. The Loran was working like a charm, giving me lat and long, steering info, miles off course, miles and time to go, mag heading and ground speed. I was going from way point to way point. It sounded the horn at each way point where I would punch the next and away I would go. This was living. The West Coast Loran stations stayed on until Nebraska then the Great Lakes chain came on. Loran coverage all the way. (The Loran used was a CLX95 from SRD Labs, McGlincey Lane, Campbell California 95008.). This particular Loran is a ferry pilot favorite, It is small, portable and has a 99 way point storage capability. I was able to pre-set all reporting points over water as well as enroute VOR's on the mainland from HNL to OSH and back to Seattle.

From Sacramento, it was 12 hours to Oshkosh to find the field closed for a thunderstorm. I diverted to Fond-Du-Lac and arrived after dark, meeting hordes of people in the same boat i.e., no place to stay. After 3 hours I finally slept in the airplane. It wasn't easy sleeping in the airplane. The worst part was that the airplane wouldn't hold a heading and I kept banking and turning for a long time even after I'd fallen asleep with one recurring nightmare. The engine would be droning away and suddenly go silent. I would wake up with real fear, open the canopy and let in more of those damn Wisconsin mosquitoes.

The numbers for Honolulu to Oshkosh were 4,497 statute miles, 32 hours, 125 gallons, 140 MPH, 3.9 GPH and 36MPG.

The trip back to Honolulu was not uneventful. The empty rear auxillary tank had a pinched vent line and imploded on let down into Oakland. Again "Lucky You Fly the Long-EZ". Ray Johnson of San Francisco, a Hospitality Club member, took my busted tank in at 9 in the evening and had it repaired by 11.

The launch from Oakland was late because of the auxiliary tank. A small leak, undetected in the initial repair, was easily repaired on the line with 5 minute epoxy, but required defueling and refueling which took about 2 hours of valuable air time. The lesson learned was: never launch late and force yourself to land at night after a long flight. Give yourself a break. A night arrival isn't tough, but things can go wrong. For me it was again the weather forecast. It turned out that I was two hours over my ETA, Honolulu, and in that two hours, there were lots of buildups, no really big ones, but it was

raining in each, rough and dark. I certainly hadn't planned it that way. I knew on this flight I was shooting for a lot smaller target than the West Coast and these additional complications provided plenty of distraction and tension. I was in contact with Honolulu Center and they wanted to know where I was and my ETA, which was a really hard question. The Loran and ADF said, "Dead Ahead", but the ETA part was an unknown. I knew I was on track. I just didn't know where. Hey, relax, I had to keep telling myself and the Center. You're flying the Long-EZ with 12 hours of fuel remaining.

The Hawaiian VOR's came on one at a time and all ended well, but I had made it grossly harder than it had to be.

If you plan to make a similar trip, give yourself every break you can on landing as well as on launch. For example, I would never recommend take off or for that matter IFR flight at high overgross in visible moisture. This is a problem which is personal to individual Long-EZ's. To get the idea, load your Long with 140 gallons of fuel then try to pick up the nose. You are going to need help. It is heavy.

On take off and in flight, the wings and the canard together must lift the total load. If you have less than a perfect canard/elevator and if your Long-EZ pitches down in moisture, you will at some overgross reach a pitch control limitation. It may be at 2,100 pounds, it may be at 1,800 or way down at 1,600 pounds. Again this is personal to your craftsmanship. If you are considering long range, overgross operations in your Long, be sure to provide your very best flight test data pertinent to this problem in you owner's handbook.

As I was planning and getting ready for this trip, I was often asked, "Why?" It's not why. It's "why not?" Mountain climbers are for the most part forced to climb mountains others have already climbed. In a Long-EZ, you have countless originals to climb. Lucky you fly the Long-EZ.

W. A. "Rodie" Rodewald
68-361 Crozier Drive
Waialua, Hawaii 96791

September 30, 1982

FAA CHECKS WHILE BUILDING YOUR EZ

It has recently come to our attention that several builders are building VariEzes and Long-EZs and have not contacted their local FAA. This is not the way to do it! It is very important that you inform the FAA that you will be building an airplane, and they in turn, will tell you when they will need to inspect it and how often. You cannot expect the FAA to come out and sign off your finished aircraft if they have never had the opportunity to periodically inspect it during it's construction. Each FAA inspector will have slightly different methods, some will want to see shear webs, and other specific parts, while others will not. You need to get to know your individual FAA inspector and work with him so that he can be helpful to you. This should be

done before you ever start construction. If you are already building and have not yet contacted your FAA, stop where you are until you have made contact and have received instructions from them as to what it is they want to inspect. Do not fool around with this, it is entirely possible for you to end up with a very expensive static display model.

AUTO FUEL IN COMPOSITE FUEL TANKS
RAF has recently received many requests to use auto fuel in VariEzes and Long-EZs. RAF cannot approve or disapprove the use of auto fuel. We can advise though, and we do not recommend using any auto fuel in a composite fuel tank. This is because of possible toluene content and its effect on the epoxy matrix. There is no way to be positive that the auto fuel you buy does not contain toluene (or possibly other potentially damaging aromatics). This is especially true of the unleaded or low lead auto fuels, which can leach the uncured epoxy residues out of the inside laminates of your fuel tanks, including the aft wall of the tank, which is your center section spar. The damage may be very insidious and may take years to become obvious. Safe-T-Poxy is much more resistant to aromatics than the previous RAE epoxy, but may still be effected in the long term.

PREFAB PARTS FROM OTHER THAN DESIGNATED DISTRIBUTORS
RAF has received many requests concerning the so-called pre-fab parts occasionally seen advertised in Sport Aviation or Trade-a-Plane. RAF categorically does not recommend any of these suppliers. Our experience has been negative in every case. In fact, there are currently at least two builders involved in legal action in an attempt to recover their money. We have seen a canard supplied to a Long-EZ builder by one of these companies. It was the worst example of workmanship we have seen. Beware of these suppliers, they may or may not provide you with the parts you require and if you do receive any part, you may never know if the parts are correctly built or structurally sound. Once a part such as a canard or a centersection spar or a wing is built, there is no way to verify if in fact all of the layups have been included and if they were done correctly.

CABIN HEAT
We have been testing the small electric heater mentioned in CP 32, page 2, for several months now. We have been satisfied with it. The one we have is a 24 volt - 16 amp heater and more than adequate. For a 12 volt installation, the 20 amp model gives approximately the same performance. These heaters are small, very light weight and put out adequate heat. They do however require an alternator. Our heater is mounted above the nose wheel well and blows heat forward at our feet. We have two manifolded motorcycle batteries and feel that the manifolded battery is mandatory with this type of heater since batteries do put out hydrogen gas while they are being charged. The manifolded battery dumps all gasses overboard.

The name and address given in CP 32, page 2 as a source for these heaters is no longer valid. Unfortunately as we go to print, there is no supplier. The guy who invented these heaters and built all of them so far, is just not set up for production. He is currently negotiating with a company to manufacture the heaters. As soon as we have a name, we will publish it.

FROM THE BUILDERS AND FLYERS

Long-EZ First Flight Report
"Dear RAF,
First flight of Long-EZ N158TG was on September 3, 1982. It now has 21 hours on it with only minor problems and adjustments. With equipment shown including strobes, nav lights, landing light and big alternator but no starter, empty weight is 800 pounds. Performance appears to be right with the handbook with 0-235 L2C engine and B and T 62 x 66 prop. I am 6 ft. 9 inches tall and pilot seating is very comfortable. My seat cushion is 1" thick in the seat increasing to 2" in the thigh support and back seat. Also, the rudder pedals are 4 1/2" forward of standard and the pedals themselves are 3" taller. I have been to 12,000 ft. and to 140 knots indicated which would be 185 mph true.

I am very pleased with the aircraft and wish to thank RAF again for the clarity of the plans and the quality of support.
Best wishes.
Tom Garrison"

Long-EZ N81KP - First Flight Report
"July 5, 1982 marked the date for the first flight of Long-EZ N81KP. WOW! What a fantastic feeling to finally rotate, lift-off and fly after 23 months of construction. It is indeed rewarding to have a safe and uneventful first flight. Thank you Mike for flying chase! It was reassuring to have you at our first flight.

Mike you mentioned that it is unusual to see a first flight in which some small problem did not arise. We feel the way to avoid these problems is to find and resolve all squawks prior to that first flight. This attitude, of course, should carry right on through the life of the airplane for every flight. It is just too late to worry about problems when you're in the air.

N81KP now has 50 hours and has been flying flawlessly. The performance of N81KP meets or exceeds all the data in the Pilot's Handbook (based on the use of wheel fairings) and as yet we have not installed our wheel fairings. We are using a Lycoming 0-235 L2C (118 hp) with a B & T, 62 x 66 prop. The basic empty weight is 811 lbs. and this includes the standard alternator, vacuum system with D.G. and A.H. and "extra-cushy" upholstery.

Regarding the high speed taxi testing in preparation for our first flight: Our tests were conducted at Chino Airport using runway 21/3 which is 6,200 feet long. This was about the right length needed to achieve canard flying speed (50 kts), rotate, hold attitude and lift-off (60-65 kts.) to 5-10 feet altitude, then touch back down and stop. This enabled us to get a good feel for the landing flare and develop roll control (which is substantially quicker than most general aviation aircraft).

We are certainly grateful to all those people at RAF who so patiently and courteously answered so many questions. Truly this kind of builder support helps dreams come true!

Sincerely,
Paul and Kim Prout". (Father and Son)

Neil Hunter reports that he feathered in the paint stripes we saw on his leading edges and he picked up 7 mph (TAS)! Neil and his son flew their Long-EZ non stop from Merritt Island, Florida to San Juan, Puerto Rico in

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7.9 hours. An average fuel burn of 5.3 gph gave a ground speed of 138 kts (159 mph). They spent the weekend with James Brandt, a Long-EZ builder who is almost ready to fly. Neil was able to check James out in his Long. James says he will be at Oshkosh '83. Neil flew his Long into Oshkosh '82 and to Kerrville, Texas.

Caution
Wes Gardner had a scary experience in his VariEze when the nose up trim spring on his pitch trim system (Long-EZ style) suddenly broke. It made a loud noise with the aircraft pitching nose down. Wes thought he had had a midair. He had trouble pulling out because the nose down spring was pulling the elevator into the nose down position. He got back to his home base ok, but was quite shaken. As if this was not enough, it has since happened to him twice. Should it ever happen to you - remember, FLY the airplane. Even with a broken trim system, it will still fly normally.

Rain Effect On Lift
We recently received a letter from Owen Billman, reporting on his Quickie accident in which moisture on the airfoil decreased his ability to climb. The result was a destroyed aircraft after striking tree tops. Our answer to him contains some information of interest to EZ flyers. While our research on rain effects is not complete, the information is published here in order to clear up some misinformation floating around.

"Dear Owen,

Thank you for sending along your account of your Quickie experience.

The subject of rain-induced boundary layer transition and its effect on trim and performance is one that we have been investigating for several years now. Tests have included fixed and free transition measurements of six different airfoil shapes on the VariEze, Long-EZ, Amsoil racer and Defiant. Full scale moisture tests have been conducted in the NASA Langley 30 x 60 wind tunnel. I have not published an account of these tests because they still contain some contradictory results. For example, theoretical predictions call for the largest trim change to exist on the well-contoured aircraft that normally have the most extensive laminar flow. Just the opposite is true - the best contoured ones have the least trim change in rain!

The trim change of the Long-EZ and VariEze in rain is generally mild. Most trim down in rain, about 25 percent of the VariEzes trim nose up. There have been several reports of a strong nose down trim change, outside of the pitch trim capability. In general, these have been fixed with a correction of canard incidence or elevator shape. I know of no rain-induced accidents with the VariEze or Long-EZ, however

several have reported extensive increases in takeoff rotation speed and take off distances.

Again, there are variances from one airplane to another. We have done low-level aerobatic maneuvers in driving rain with our Long-EZs without noticing any major difference in maneuverability. We have no operational limitations for flying in rain except to throttle back to save the propeller leading edges from erosion.

Fix transition test conducted by applying grit on the leading edges (at 4 percent chord top and bottom) has shown that maximum lift is reduced significantly, increasing the minimum speed by about 8 knots. The NASA wind tunnel tests (see the adjacent plot of CL with fixed, free and wet surfaces) seem to predict that the EZ has about half the degradation in rain as for fixed transition. This approximately four to five knot increase in minimum speed while wet generally is not a problem since we all seem to fly a bit more conservatively in the weather.

Our tests with new airfoil designed to reduce the rain-induced trim have not led to changes on the Long-EZ since they have all shown degraded low speed performance (less lift). The low Reynolds-number if 0.5 million is a particularly difficult section design area. The Defiant's canard operates at twice the RN. It has a very mild nose up change in rain and no measurable effect on take off speeds. The Defiant doesn't have a trim change with airframe ice. Long-EZ N26MS has a moderate nose down trim change with rime ice.

Concerning your Quickie and others that have near equal-area tandem wings: we have not conducted fixed transition or moisture test on these, but based on your and others experience, it appears that the transition effect on maximum lift is more severe. This is apparently due to the double effect of loss of CL and the inability to trim to an adequate angle-of-attack. I have referred your letter to Quickie Aircraft Corporation. They no doubt will be conducting tests and/or making recommendations or improvements to prevent recurrence of your accident.

Best Regards,
Burt Rutan"

GRAPHS OF EFFECT OF WATER SPRAY ON CANARD AERODYNAMICS OMITTED

ACCIDENTS AND INCIDENTS
A southern California VariEze headed for Oshkosh flew into trees in a steep box canyon east of Salt Lake City airport resulting in two fatalities. The weather in the mountains east of Salt Lake was clobbered with low clouds. A pilot who departed Salt Lake City just before said that he would not have tried to go east, due to low ceilings and poor visibility. The pilot apparently selected the wrong canyon thinking it was the main pass that would lead him through the mountains.

The pilot and passenger of a California VariEze were fatally injured in northern California. According to the NTSB, the pilot was giving a friend a first ride, made a low altitude pass over the runway, started to climb and as the aircraft passed over the lake shore began a barrel

roll to the right. The airplane only completed about 270 degrees of the roll when it struck the surface of the lake.

The pilot of a southern California Long-EZ was seriously injured and his passenger suffered a broken hip when the airplane crashed into a dry river bed. The eye witnesses to the accident reported that the airplane was doing aerobatics. It appeared to enter the beginning of a loop, did not have enough speed, fell out of the maneuver. The engine stopped, (negative "g" will cause a carbureted engine to suffer fuel starvation) the aircraft nosed over and spiralled down to about 100 feet, where its wings were leveled and it descended until it struck the ground. The aircraft hit a 20 degree embankment almost wings level and slid forward only about two feet. There was no fire, although the right fuel tank was ruptured.

Incident - A VariEze pilot from Colorado reports that his VariEze received extensive damage during an aborted take off. A thunderstorm was located at the upwind end of the runway, so a downwind take off was initiated. Unfortunately the runway sloped uphill in this direction. The pilot aborted at about 3/4 of the runway length, but was too late to stop on the wet runway. The aircraft ran off the end, crossed a ditch, went through a barbed wire fence and down a rocky embankment. The pilot was unhurt.

Don't allow yourself to be deluded into thinking that you cannot get into trouble in your VariEze or Long-EZ. These aircraft are tremendous confidence builders, but they are still aircraft and unless treated with respect, will bite. A VariEze pilot, trying to fly through a canyon near the Snake River, encountered such a severe down draft, that he only just managed to execute a 180 degree turn. He lost 2000 feet and recovered less than 300 feet from the ground. He had previously believed that no matter what, his VariEze would get him out of trouble. Don't push your luck. We recently checked what would happen to a Long-EZ, with full aft stick, both rudders all the way out, nose gear extended and engine at hard idle. The airplane developed a sink rate that varied between 950 fpm and 1250 fpm. This was also tried with the prop stopped. You cannot expect to walk away from this kind of impact. 1250 fpm is 21 feet per second or 14.5 mph. You must get the nose down and build enough airspeed to have sufficient energy to arrest your descent with a flare.

A VariEze pilot from Northern California flying from Stockton to Florida, heard a 'different' noise but before he could do anything, one exhaust stack (original style) cracked off and went through the prop removing about 17 inches of one blade. The vibration was so severe that it broke both mag wires and failed the mixture cable/spring assembly. He pulled the mixture and switched off both mags. When this did not work, he turned off the fuel valve and finally the engine stopped. He made an uneventful landing on a highway near Zuni, New Mexico. He found that the top engine mounts had failed and the engine was lying in the cowling. This pilot stayed very cool, flew the airplane and kept thinking all the way. Don't forget to fly the airplane.

The reason we report accidents and incidents such as these above, is in the hope that someone may benefit by the experiences related. Aerobatics can be fun, but they can also be very dangerous, especially at low altitude. RAF does not recommend aerobatics in either the VariEze or Long-EZ. Apart from the obvious reasons, airfoils, no inverted systems, etc., both of these aircraft are extremely clean and will build up speed in a dive with frightening rapidity. A competent aerobatic pilot can do some of the positive "g" maneuvers, however it takes very careful speed control and anyone contemplating such a thing should take a course in aerobatics from a professional.

Because of the excellent flying qualities of the Long-EZ it is a temptation to do more than that for which we are qualified. Do be aware of this, get the necessary training before going out in your VariEze or Long-EZ and "train" yourself.

Installation Instructions for Prefab Wheel Pant from Aircraft Spruce or Wicks Aircraft. (500 X 5)

NOTE: All twelve prefab fiberglass parts are labeled (six left and six right).

The approximate tire clearance cut out is scribed and the axle centerlines are marked.

1. Make an aluminum bracket as shown using .063 2024T3. Mount this bracket vertically on the inboard side of the main gear strut using the four nuts that attach the axle. **SKETCH OMITTED**
2. Cut out tire clearance hole in the bottom of the outboard pieces.
3. Use gray tape (duct tape) to tape the two halves together.
4. Fit the four prefab corner pieces into their correct positions by reaching in through the tire clearance hole. The proper position of these parts are marked on them (ie. right bottom aft). Using a #30 drill bit, drill four evenly spaced holes through the three long corner pieces and the inboard wheel pant half. Drill three evenly spaced holes through the short piece marked, bottom forward and the inboard wheel pant half. Drill three holes through each corner piece and the outboard wheel pant half. Install clecos in these holes as you drill them.
5. Drill four #18 holes, evenly spaced, through the outboard wheel pant half into each of the three long corner pieces and drill three evenly spaced holes through the outboard wheel pant into the short corner piece.
6. Remove the clecos and separate the two halves. Pop rivet K1000-08 nut plates inside the 4 corner pieces.
7. Use a gray tape or saran wrap release on all edges not to be bonded and sand the inside of the halves and the matching corner pieces dull.
8. Reassemble two halves to check for a good fit to each using AN 525-832R7 and clecos.
9. Leave screws in place and remove clecos to disassemble.
10 Apply a generous coat of wet flox to all surfaces to be bonded - reassemble using flush head pop rivets in place of the clecos. Allow to cure.
11. Drill a #30 hole at the marked axle centerline and position the inside half of the wheel pant on the strut using the #30 hole as a guide for correct height and tire clearance hole as a fore-aft guide. Position the wheel pant approximately 3 degrees nose down for least

drag at cruise. Drill two #30 holes through the inboard pant half and .064 aluminum bracket and cleco inboard pant to aluminum bracket.

SKETCH OMITTED

12. Drill a #30 hole approximately 5/16" inch below or to one side of the marked axle centerline (see sketch) and fit outboard pant into position. Push a small wire through the #30 hole to measure the distance from the outboard pant to the end of the axle. This will be about 1 1/2". Remove the outboard pant and make a wood pyramid shaped block, the correct height and flox it into place on the inside of the outboard wheel pant. Layup 2 plies of BID lapping .7 onto the pant.
13. After this cures, drill through the #30 locating hole with a 1/4 inch drill. Refit the outboard pant half and drill through the 1/4 inch hole into the end of the axle, approximately 1/4 inch deep. Use a #3 drill and drill the hole 3/4 inch deep and tap this hole with a 1/4-28 tap. (CAUTION - This 1/4-28 tapped hole is not drilled in the center of the axle due the cotter pin location, rather it is drilled offset per sketch).

SKETCH OMITTED

14. Use an AN4 bolt and wide area washer to attach outboard pant to axle, such that the bolt grip extends through the wood and glass pyramid block into the axle, this assures that no shear loads are transmitted through the bolt threads. See sketch.
15. Drill #10 holes through inboard wheel pant half and .064 aluminum bracket. Remove pant halves and rivet K1000-3 nut plates to.064 aluminum bracket.
16. Sand and finish wheel pants and reinstall.

SKETCH OMITTED

Parts needed.

2	- AN4-20A	Bolt
	- AN970-3	Washer
30	- AN525-832R7	Screws
4	- AN3-5A	Bolts
4	- AN960-10L	Washers
4	- K1000-3	Nutplates
30	- K1000-08	Nutplates

30 - Pop rivets - 1/8 Avex # 1604 04 -12
68 - 3/32 Cherry pop rivets MSC-32

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LONG-EZ PLANS CHANGES

LPC #103 DES
Long-EZ Owner's Manual page 21, first paragraph, "carbon dioxide-type" should be "dry type fire extinguisher".

LPC #104 MEO
Section I, page 20-2, second paragraph, "3rd ply is on the upper surface only" change "surface" to "winglet" to clarify.

LPC #105 MEO
Section I, page 6-3. The 1" x .7" x 3" wood doubler should be glassed over with 1 ply BID at 45 degrees, lapping .4" onto F28, top longeron and fuselage side.

LPC #106 DES
Section I, page 22-3, system II with alternator. The wiring diagram does not show an alternator circuit breaker between the B plus alternator terminal and the battery. This protection is very important and the circuit breaker should be sized to the maximum output of the alternator. For example a 35 amp alternator should have a 40 amp breaker.

LPC #107, MEO
Section I, page 19-8, step 10 clarification. The root of the aileron should be cut at 90 degrees to the trailing edge along the line on the top skin to the hinge line defined by the 5.9 dimension. This cut is a vertical plane and will not pass through the point on the bottom skin that is defined by the 7.6" dimension.

VARIEZE PLANS CHANGES

MAN
Aileron hinge pins must be saftied. The hinge pins can vibrate out of the hinges as the wing trailing edge wears away. The best way to safety the hinge pins, is to remove the pins, cut them 1/4" shorter. Reinstall them and drill a small hole through each end of the hinge knuckle and safety with a piece of safety wire. See sketch. **SKETCH OMITTED**

FOAM SUBSTITUTES

We have approved a new PVC foam, Divinycel, which is various shades of tan to light brown. It is a good quality and also cheaper. This foam is a direct substitute for all of the Klegecel PVC foam called out in the bill of materials. If your kit contains tan colored PVC foam, check carefully to be sure that you are making parts from the correct density foam.

Old Specs	New approved substitute
Type R45, 3 lb/cubic ft 8 pcs. 32x48x.35" dark blue	Type H45, 3 lb/cubic ft 8 pcs. 34x47x3/8" tan
Type R45, 3 lb/cubic ft 5 pcs. 24x48x.8" dark blue	Type H45, 3 lb/cubic ft 5 pcs. 26x47x3/4" tan
Type R45, 3 lb/cubic ft 2 pcs. 24x48x1.6" dark blue	Type H45, 3 lb/cubic ft 2 pcs. 26x47x1 3/4" tan
Type R100, 6 lb/cubic ft 2 pcs. 35x44x1/4" red	Type H100, 6 lb/cubic ft 2 pcs. 34x37x1/4" tan
Type R100, 6 lb/cubic ft 1 pc. 6x10x1" red	Type H100, 6 lb/cubic ft 1 pc. 6x10x1" tan
Type R250, 16 lb/cubic ft 2 pcs. 26x37x2" red	Type H250, 16 lb/cubic ft 2 pcs. 26x30x1/4" tan

CARTOON OMITTED

BUILDER HINTS

A good method to form the foam for the top and bottom fuel/baggage strakes is as follows: support the foam appropriately; place two layers of dry bath towels at the area to be curved, soak the towels with 4 to 6 quarts of boiling water. The foam will easily form to the desired shape. Allow to cool, remove the towels and be certain not to glass over the foam until it is completely dry. **SKETCH OMITTED**

Sam Harris suggests leaving the hardener out of acrylic enamels on parts such as elevators and ailerons. The weight of the finish will thus be reduced by almost 50 percent. Sam also suggests substituting 601 fuel hose for the 303 called out, it is easier to use in the small space.

Brent Parsons suggests taking a coat hanger wire, bend it to form a 1" wide 'u' shape about 5" long and install it into a 250 w soldering gun. This can be used to rapidly and cleanly remove the blue foam in the canard for installation of the high density foam blocks. **SKETCH OMITTED**

Gerald Collins reports that he had a problem with his nose gear retract system. When he taxied over rough ground, occasionally he noticed the handle would turn perhaps a half turn. He paid no attention, until taxiing at no more than 10 mph over rough asphalt, he was suddenly looking down at the taxiway. The retract mechanism had bounced out of the over center position. This put all the loads on the cast iron worm gear, which stripped and let the plane down hard on its nose block. Nose damage was minimal. To minimize the possibility of this occurring, be certain that your nose gear box is mounted at the correct angle so that when it is down and locked, it is well over center as shown in the plans. The installed system generally had adequate friction to prevent backoff. However, if your mechanism becomes loose and allows your gear to extend a little in flight, you can install a spring loaded friction lock. (See sketch). **SKETCH OMITTED**

Ray Cullen reports good success with small "mud flaps" on the wheel pants. After three months of hard operation, prop nicks are minimal. The small "mud flaps" are made from plastic coffee can lids pop-riveted to a 3" x 1" bracket made from .018 stainless (firewall material). These flaps should have at least 1/4" of clearance from the tire.

Gary Hertzler has had a "fender" on his nosewheel for some time and it too is a big help as far as prop damage. Gary made his fender from 3 plies BID and it has a small "mud flap" of engine baffle material (neoprene/asbestos) or the plastic coffee can lid would probably work fine. These mud flaps should be quite close to the runway, if they are too long, they won't be after one take off!

Mag Switch Location - Ken Clunis sent this in and it is an excellent idea. Ken put his mag switches on the left side of the roll over structure. In this position they are easy to see from outside the plane, particularly if you hand prop your engine and, they are convenient to operate with your left hand while seated in the front seat. Of course they are accessible to the back seat passenger, should the pilot ever become incapacitated.

28 Volt Electrical System - The main advantage of going to a 28 volt system is that all of the wiring is 1/2 the size (actually 3 wire sizes smaller). This is a considerable weight savings. All lamps, strobes, radios, etc. are available in 28 volts and the used market prices are generally less than the more popular 14 volt. Two motorcycle batteries wired in series do an excellent job. They should be manifolded and 12 V - 15 AMP hours minimum, such as you would find in a Honda 350 cc. All of the wiring can be pushed through a lightweight plastic or teflon tube 1/2" to 3/4" diameter installed down either side, from the aft seat bulkhead to the instrument panel. These can be floxed or siliconed into place. If you ever have to add a wire or two, it is easy.

Ken Clunis mounted his transponder vertically in the right forward baggage strake, against the fuselage side. It is easy to read and easy to operate with your left hand. His antenna (RST type) is in the right side of the centersection spar, as far outboard as possible, ground plane must be horizontal with the antenna vertical and pointed down.

Spar caps - wings, canard and centersection - Be sure to peel ply these spar caps, or you will wear yourself out sanding prior to installing the skins.

Brake torque plates - Check to see that the torque plates fit flush on to the axle flange. Occasionally the hole in the torque plate will interfere with the radius between the axle and flange. Careful filing or grinding of the corner in the torque plate will allow a perfect flush fit. See sketch. **SKETCH OMITTED**

If you are installing a VariEze cowl on your Long-EZ, you may find the bottom cowl does not match well to the wing root, after cutting the cowl to the correct width. Paul Adrien came up with a neat solution. He simply glued a piece of styrofoam or urethane foam to the wing root. Then shaped it to fit the gap between the wing root and the lower cowl. Glass over the foam with 2 plies of BID. This makes a nice transition without reshaping the cowl and leaves more room in the cowl for the exhaust. See Photos. **PHOTOS AND SKETCH OMITTED**

CAUTION - Ray Cullen painted his exhaust system white using Krylon high temp paint, per the instructions. After about 3 hours of flight, the engine abruptly stopped on the take off roll and could not be restarted. Complete disassembly of the carburetor disclosed the problem. The carb induction tube and venturi area were full of white paint chips, which had flaked off the exhaust system. Apparently when carb heat was used, the paint chips were drawn into the induction. The air filter was clear. Ray blew the carb out with air and sand blasted the exhaust. The engine started immediately and he has since flown 60 hours with no problem. The moral: do nothing to your exhaust system that could possibly introduce foreign material into the carb heat system.

Nose Wheel Shimmy

We have cautioned EZ pilots about nose gear shimmy damper adjustment in the last two Canard Pushers, yet we still have EZs losing their nosewheels. It is a fact that your nosewheel fork will fail if you experience shimmy on landing or take off. It is also a fact, that if the friction damper is correctly adjusted, you will not have shimmy at all. The nosewheel fork will not fail due to a normal landing. It is very strong, the original fork has been grossly overloaded to the point of failing the NG15A casting and/or the 1/8" aluminum plate on the forward face of the NG15A casting. Yet the fork was not damaged. This has occurred several times. We are satisfied that the fork will fail only if it shimmies. Therefore if you keep the friction damper adjusted and check it regularly, you will not have this problem. Every time you extend the nose gear, just before you get into your EZ, hold the nose wheel clear of the ground and use your foot on the trailing edge of the nosewheel tire to check the friction. You will soon get

"calibrated". You should have to push or pull 3 to 5 lbs to pivot the fork.

When taking off, try to rotate positively, hold it down until you have the proper speed, then rotate smoothly. Try to keep the nose wheel from touching back down or skipping, this is when shimmy is most likely, at the instant of a light touchdown. The same applies to landing. Hold the nose wheel off until you are traveling as slowly as possible. Then let the nose down and hold it down with forward stick. Do not let it skip. Avoid nosewheel touchdown at very high speed.

If you follow these simple steps you will minimize any chance of shimmy and therefore the chances of losing a nosewheel. The prototype Long-EZ still has the original thin wall fork and with over 680 hours, has never experienced any shimmy. N26MS has almost 500 hours with probably more take off and landings than the prototype and it too has not had nose gear problems. Dick and Jeana have the high time Long-EZ with over 700 hours and also have not had shimmy or nose wheel failures. There is a lesson here - get into the habit of preflighting your nose gear. Keep your friction damper correctly adjusted.

SHOPPING

The Long-EZ lithograph, shown on the back page of CP 33 is available from RAF. This drawing was done by the well known aviation illustrator, Jim Neuman. It is a must for anyone building a Long-EZ. It is printed on heavy linen paper. The price is $10 which includes postage and handling. California residents, please include 6 percent sales tax.

RAF has T-shirts in stock. We have pale blue and cream shirts with a Long-EZ and the logo "Laughter Silvered Wings" for $8.00. We also have the white T-shirts with a cartoon type EZ on its nose with the logo, "I fly a nose dragger", at $7.00. All the shirts come in adult sizes, small, medium, large and extra large. Some children sizes are also available. The ladies shirt in both types is the french cut style.

RAF has available the "Long-EZ Plans Changes and Builder Hints" done by Neal Johnson. These are most useful as they are organized by chapter order. The price is $7.00. They are also available directly from;

Neal Johnson,
P.O. Box 51,
Monroe, LA 71201

Task Research fuel strakes with ribs and baffles - on sale November 10, 1982 for $884.00. 50 sets only. No orders will be taken before November 10. Mail orders only with a 50 percent deposit. NO phone orders will be taken. NO exceptions. Write:

Task Research
848 East Santa Maria
Santa Paula, CA 93060

B & C Specialty Products
518 Sunnyside Court
Newton, KS 67114
(316)283-8662

B & C has several different alternators to fit both Continental powered and Lycoming powered VariEzes and Long-EZs. 12 volt, 8 amp, 10 amp, 12 amp and 35 amp alternators are available.

B & C Specialty Products is proud to make available a new and better way to cut your fiberglass cloth! It is a heavy duty knife with a rolling disc blade (similar to a pizza cutter). It can be used with either hand, may easily be used with a straight edge and will cut glass, cloth, leather, paper, vinyl, etc. The knife also has a built in retractable safety cover. The blades are replaceable and are made out of high quality tungsten steel for long life (1 3/4" diameter). Use a piece of styrene plastic as a cutting surface. The knife comes with one blade for $9.00. Extra blades are $3.50 each. Special Introductory Price:

1 - knife with blade	$9.00
1 - Extra blade	$3.50
Shipping and handling	$1.75
Total	$14.75
SPECIAL	$12.75

Harold Hoffmann
Box 641
Winsted, MN 55395
Continental O-200 - Half run out
Please write - no calls

Peter Spanovic
187 Ben Franklin Dr.
Reno, NV 89509
702-786-7525
Continental C-85 - for sale or trade for a Lycoming GPU

C. G. Reinmuth
3933 South 48th St.
Lincoln, NB 69506
Original VariEze main gear strut

Fred Sanders
3207 Wildwood Dr.
Huntsville, AL 35801
(205)534-8186
Lycoming O-235 C1 - approximately 100 hours since chrome major.

Bob Coon
26 Cloverdale St.
Pittsfield, MA 01201
New improved "Canard Pusher" index now available. Eleven pages includes newsletters #16 through #33. $3.95 includes postage. Bob also has the cutaway drawing of the VariEze. Printed on 17" x 24" paper, it is suitable for framing. While they last - $4.95 each or $10.00 for three.

Wes Gardner
1310 Garden St.
Redland, CA
(714)792-1565

Wes has available a reusable carb foam air filter that is suitable for VariEzes and Long-EZs. Mike Melvill and Dick Rutan have these filters on their Long-EZs and are pleased with them.

The Compucruise with the aircraft grade Flo-Scan fuel flow transducer, together with the "gizmo" to dial in ground speed, will soon be available from Byron McKean. It will be available in several different configurations. Byron will be stocking all 3 items and will build them to suit, that is, you can remote mount the keyboard or display, or mount them together. Contact Byron for brochure and order blank.
Byron McKean
RT #1, Box 429-B
McQueeny, TX 78123
(512)557-6575 NO collect calls.

VARIVIGGEN NEWS

N27MS almost did not make it to Oshkosh this year. I flew the Grizzly out and the Defiant back, so was not able to fly her myself. Jeana Yeager volunteered! After a short check out, she spent an hour or two practicing landings at Mojave, then carefully cleaned and polished the whole airplane. I don't think the Viggen has ever been so clean! We had to install a 25 lb. lead shot bag way up in the nose, because Jeana only weighs 100 lbs.

Jeana did not have any problems with the Viggen. I demonstrated the pitch trim change, with power changes and also the high sink rate with power off. We practiced a few simulated power off landings, then she was ready and she honestly never made a bad landing. Jeana had a ball on the way to and from Oshkosh. The only squawk was a short in the number one comm radio, caused by water. Just over 30 hours was added to the log book, bringing the Viggen's total time to 560 hours. Thanks, Jeana.

Ken Winter once again flew his Viggen to Oshkosh. If you remember last year it was painted only in primer gray. This year it was sporting an excellent paint scheme of red, white and black. Ken called it a "commanding" paint scheme and he is not kidding.

No other Viggens made it. Len Dobson had to have surgery on his hip just three days before Oshkosh, so was unable to make it. He did have it at the Kerrville, Texas Flyin. Except for the color of the trim, it looked almost exactly like mine! Arthur Scwartz had more bad luck this year. Last year he flew as far as Youngstown, Ohio from his home in New York. This year, he actually got beyond Oshkosh. He arrived early, so decided to visit friends in Iowa. Near Cedar Falls, Iowa, the aircraft experienced a stuck valve. He landed and had a mechanic repair the problem and took off only to have another valve stick. This time he had the mechanic check all the valves, both inlet and exhaust. Somehow, during all this, the back cockpit canopy was opened and not locked closed. Arthur took off and was climbing out when the back canopy opened. It cracked and pieces of plexiglass went through the prop and damaged one vertical fin. Arthur shut the engine down and managed to make it back to the runway executing an excellent landing.

Arthur returned home to New York for a second prop and some epoxy and plywood. He repaired the bird, and flew it back to home base. Maybe next year, Arthur?

Bill Campbell's Viggen is ready to go at Rialto Airport in California. It may have made its first flight by the time you read this. We heard rumors of a Viggen ready to fly in Canada. Rumor has it that this Viggen has a 6 cylinder Franklin engine. Let us know if you know of this aircraft.

Jim Cavis has sold his Viggen engine, firewall aft and has the rest of his project for sale, all or part of it.

Contact: Jim Cavis,
8220 E Plaza
Scottsdale, AZ 85253
(602) 945-0430

Help Wanted

Scaled is still in need of a few good shop bodies to start after Christmas. Work will include helping with layups, building tooling and jigs, sweeping floors, etc. Salary range $5-7 per hour.
Contact:
Herb Iversen
Scaled Composites Inc.
Hangar 78 Airport,
Mojave, CA 93501
(805)824-2842

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

35 Amp alternator kit for a Lycoming powered Long-EZ. Total weight = 9.3 lbs.

B & C Specialty Products 12 volt 8 Amp alternator, mounts on the vacuum pad of any Lycoming engine. Total weight = 3.8 lbs.

Bud McHolland, 68 years old of Sheridan, Wyoming built and flight tested this beautiful VariEze. It is one of the cleanest we have seen.

This is a cake!! Paul and Kim Prout of Chino, California gave a big "thank you" hanger party after the flawless first flight of their excellent Long-EZ N81KP.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dr. Paul Adrian's Long-EZ wing root to cowling joint. He had a VariEze cowl and used this very neat method of matching his lower cowl to the wing and left himself plenty of room for his exhaust system. See "Builder Hints", page 8.

J. Civetta's Long-EZ, the first to be completed in Europe, on the ramp with three French VariEzes at La Grande Motte, France.

Al Coha (San Diego VariEze builder/flyer), Bill Allen and Ivan Shaw standing by Ivan's beautiful VariEze "Mistress" at Staverton Airport in Gloucestershire, England.

Main gear on N26MS, showing location of axle bolts, brake caliper, brake line & relief tube (insulated with fiberfrax). The wheel pant bracket has been removed for this photo.

Mike Rhodes and family, "trying it on for size".

Charlie Gray's technique for holding the wings to the centersection spar, prior to drilling in the attach bolt holes. Hardware store turnbuckles and cable - neat!

"Charlie's Outdoor Factory". The advantages of Miami's climate are obvious in this shot of Charlie's Long-EZ in the final stages.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Ultimate (1.5 x design limit) load on the Solitaire's vertical tail.

Preparing for the canard load test. Solitaire is well supported about 48" above the floor.

Design limit, 4.67 'g' on the Solitaire canard. The lead shot bags are positioned aft of the center of pressure to simultaneously simulate design limit torsion.

Ready for the main wing load test - note NGT jet trainer, suspended from the hangar ceiling.

Mike Melvill and Michael Dilley with Solitaire after the evening airshow at Oshkosh, '82.

Main wing at ultimate bending and torsion (1.5) x design limit, 4.67 'g'). Wing tips deflected over 46"!

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.1ft
Area	94.8 sq. ft.
Empty Basic	750 lb.
Empty Equipped	800 lb.
Solo Weight	1000 lb
Gross Weight	1425 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	600/950 ft
Climb (solo/gross)	1750/1250 fpm

Cruise 75% 8000 ft	186 mph
Cruise 40% 12000 ft	146 mph
Top Speed - Sea Level	193 mph
Max range * 75% (solo/2 place)	1380/1150 mi
Max range * 40% (solo/2 place)	2070/1690 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 full size drawings. It includes many photos, over 800 drawings and 65,000 words. The builder is led step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components. A video tape is available covering all aspects of building the moldless fiberglass/foam sandwich construction. The tape covers the latest methods used to obtain the optimum weight, strongest fiberglass lay ups. This presentation will help both the first-time and experienced builder and attain quality aircraft workmanship.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction for the complete engine installation, including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

A video tape is also available which covers the weight and balance procedures, taxi tests and first flight.

LANDING BRAKE - Complete full size drawings for the landing brake device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail to U.S. & Canada	Overseas Airmail - U.S Funds
Rutan Aircraft Information Package - complete data and photos of all Rutan designs.	$ 8.00	$ 9.00
"Canard Pusher" newsletter Published quarterly. One year subscription. Approx. 10,000 words per issue.	6.75	8.75

Long-EZ plans. Section I	198.50	212.50
Section IIL Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00

6% Sales Tax, if Calif. order.

Newsletter not taxable.

The following are RAF-authorized distributors of Long-EZ materials and components. Contact the distributors at the addresses below for their and description of items.

ALL RAW MATERIALS AND PREFAB FIBERGLASS PARTS

Near Los Angeles
AIRCRAFT SPRUCE
201 W. Truslow, Box 424
Fullerton, CA 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT
401 Pine Street
Highland, IL 62249
(618) 654-7447
Catalog $3

Prefab machine parts such as, control system parts and welded parts, fuel caps, engine mount, rudder pedals and exhaust systems.
KEN BROCK MANUFACTURING
11852 Western Avenue
Stanton, CA 90680
(714) 898-4366
Catalog $3

Main and nose gear, fuel strakes, fuselage bulkheads.
TASK RESEARCH INC.
848 East Santa Maria
Santa Paula, CA 93060
(805) 525-4545

Canopies are available from RUTAN AIRCRAFT.

RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

Canard Pushers from 1 to 82

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Eleven Rutan Designs - front and center at Oshkosh, 1982

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THE CANARD PUSHER NO 35 JAN 83

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 35. If you are building from 2nd Edition plans you must have newsletters 18 through 35. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 35. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 35. If you are building a Long-EZ you must have newsletters from 24 through 35.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 on Saturday. Closed Sunday.
If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
Solitaire continues to occupy most of our time, what with plans preparation, and fine tuning the controls system and engine installation. We are close to a design freeze and are pleased with the little airplane.

We are very pleased to welcome Bruce Evans to RAF. Bruce will be working exclusively on Voyager and has already proven to be an excellent asset. Bruce built and is currently flying a very pretty VariEze nicknamed "Sky Slug". He has over 500 hours on his bird and does a lot of travelling, including many trips into the Baja Peninsula.

SOLITAIRE
Solitaire has been doing lots of flying. Einar Enervoldson, a NASA test pilot, and one of the SSA contest judges has flown many flights in it, in preparation for an upcoming pilot report article in Soaring magazine. This should be an interesting article as Einar went to a lot of trouble to calibrate airspeed and altimeter. We did a lot of flying looking for that elusive "perfectly smooth" air.

The Solitaire prototype has used a pitch control system that consists of two housed push-pull cables. That system, while being simple to install, induced friction that degraded the pitch flying qualities. Last week we built and installed a completely new pitch control system and stick, as well as a bungee pitch trim system. We are very pleased with the result. While we were at it, we installed adjustable rudder pedals to take care of the wide variety of pilots who will fly Solitaire. Remember, since the pilot sits at the cg, there is virtually no cg shift from a light pilot (100 lbs.) to a heavy pilot (200 lbs.). We felt that adjustable rudder pedals were essential.

We have been extensively testing the KFM engine for self launch. It has been flawless and provides adequate power. We conducted all of the engine tests with the engine fixed on a pylon. The airplane is now in the shop for the final change, which is to make the engine/prop assembly fold in and out. We are nearly there. We have had the KFM engine on a dyno, and have developed an excellent exhaust system.

Michael Dilley checked out in the Solitaire last week with no problems at all. Michael is a relatively low time (200 hour) private pilot, with no sailplane time at all. He had such a ball, we thought we'd have to shoot him down!

We will have the Solitaire up at Reno, Nevada for the SSA Annual Convention from 23 March to 27 March. It will be on display at the MGM Hotel at the Convention site.

We are working hard on the plans, but realistically it looks like it will be April before we have them available. Rest assured, we are doing our best.

"STEERABLE NOSEWHEEL FOR THE LONG-EZ?"
We have worked very hard to develop a nosewheel steering system for the Long-EZ. This endeavor has been a dismal failure so far. It really is a much more complicated problem than it seemed at first. We have had several different iterations installed including two totally new nosewheel forks. None of our efforts have shown enough promise to pursue. What it boils down to would be a major redesign of the rudder/brake system, as well as the nose gear. At this point in time we are going to put this project very much on the back burner. The Long-EZ is such a simple, easy to maintain machine as it is, a change such as that suggested above, would necessarily make it more complicated and difficult, not to mention expensive to maintain. Of course this still leaves us with the need to be very conscious of the necessity to carefully check the friction damper before every flight. We have four aircraft here at RAF with the standard nose gear. These four aircraft have an accumulated total of over 2,500 hours, and heaven knows how many landings. None of these airplanes has ever experienced nose wheel shimmy of any kind, and no nose wheel fork failures, even

when N79RA was deliberately run over pieces of 4" x 4" lumber at speeds from 20 mph to 50 mph. Check your friction often and you will be rewarded with lots of fun flying - neglect it, and you will pay the price of a shimmy-induced fork failure.

From Irene Rutan - Burt's Mom
"Because of the overbooking last year at the VHC Banquet and the inability to handle everyone, this year's banquet is for members only. Because of these limitations, I am wondering if there is enough interest in having a separate banquet on a different night"

If so, please contact:
Mrs. Irene Rutan
8526 Calmada
Whittier, CA 90605

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Effects Of Rain Or Surface Contamination On Pitch Stability And Control

Last Canard Pusher we discussed again the effects of rain or surface contamination on the pitch flying qualities of the Long-EZ. This subject has been addressed and discussed in the Owner's Manual since it was discovered in 1975 that our VariEze prototype experienced a nose up trim change when encountering IFR conditions or flight in rain. This phenomena had not been encountered during our earlier experience with the VariViggen aircraft. At that time it was recognized that assessing the trim change due to boundary layer trim transition, (i.e.: due to leading edge insect accumulation or flight into rain conditions) would need to be accomplished in order to verify that the effect on the pitch flying qualities would not be adverse. Studies subsequently done using data from many different VariEzes did not reveal consistent results in that some of the airplanes would tend to trim nose up when entering rain conditions and others would tend to trim nose down when entering flight into moisture. Occasionally a VariEze was found to exhibit a relatively strong nose down trim change which would require several pounds of stick force to maintain the same flight condition and require a retrimming when entering or leaving rain conditions. The confusing result about the investigation was that there was an apparent disagreement between theory and flight test data. Theory would predict that if an airplane were relatively rough to begin with, the trim change should be less than that experienced than on a very clean well built surface in which a larger extent of laminar flow is lost when entering rain.

Experience with conventional airplanes and investigation of test data for wing sections in general revealed that when an aircraft enters rain, it's flying surfaces produce less lift at a given angle of attack and also the maximum lift is reduced resulting in a higher stall speed. At the time NASA was testing a full scale VariEze in the 30' x 60' wind tunnel at Langley and we asked Joe Chambers, director of those tests, to spray water on the aircraft and attempt to measure the change in lift and to compare that change with that found when the laminar boundary layer is transitioned by applying grit or tape near the leading edge. The results of those tests were published in the last CP and show a definite loss of maximum lift. The NASA wind tunnel tests

indicated that a larger elevator deflection is required to fly in rain conditions. This was an expected result for some of the aircraft which had reported a definite aft stick requirement when entering rain.

We instrumented the VariEze prototype, N4EZ with an accurate elevator position indicator and gathered the elevator position versus speed data shown in the adjacent plot. Upon landing we applied grit and tape to the aircraft flying surfaces, wing and canard to provide a positive transition of the boundary layer at 5% of chord. This consisted of adding a "step" to the otherwise smooth surface of the airfoil that was sufficient to destroy all the laminar flow, a condition caused by either an accumulation of insects on the leading edge, or flight in rain. We then added the fuel used during the first flight to bring the airplane back to the same exact gross weight and cg and flew again gathering the same elevator position data. As shown in the adjacent plot the elevator position required to achieve a given indicated speed was greater than with the smooth surfaces. It should be emphasized though, that the trim change that the pilot feels is not the same as the shifted elevator position since the transitioned boundary layer alters the pressure distribution around the elevator. Even though the elevator is more trailing edge down it does not necessarily result in an aft stick force. In the case of the VariEze N4EZ, the trim change due to the trim change transition (the force required to fly the airplane without adjusting the trim lever) is extremely small and is for most of the flight regime not noticeable as a nose down trim change.

The NASA concern for a greatly increased stall speed, was not achieved as you can see from the data, the minimum speed achieved with the transitioned aircraft was higher, but only by approximately 1 to 2 knots.

While we are discussing the VariEze elevator data it is interesting to note the shape of these curves and discuss why the VariEze was designed in a way to provide natural stall limiting. Notice that as the pilot slows up, the normal stability requires a greater elevator position. The shape of this elevator position versus speed curve is similar to a conventional airplane at all speeds above approximately 55 knots. As the airplane slows to less than 55 knots however, the pilot notes that all of a sudden he requires a large change in elevator position to achieve a small reduction in speed. For example from the elevator position of 4 degrees at 53 knots, the pilot can apply an additional 8 degrees elevator and only slow down to 48 knots. As he pulls the stick back further the elevator itself and the canard begin to stall and the airplane "bobs" noticeably up and down. If the pilot pulls the stick back an additional 6 degrees or more, (greater than 18 degrees elevator position) the airplane begins a very apparent pitch bucking i.e.: The nose bucks up and down a couple of degrees approximately once every two seconds. This is a generally stable flight condition and the full use of yaw and roll control is retained. Compare this to a conventional airplane: when the elevator is brought back, a stall of the main wing and the airplane either drops or "departs" (rolls to one side or yaws into a spin).

Note that transitioning the boundary layer did not change the highly desirable shape of these curves, it only resulted in a minor increase in the minimum speed. Looking at the high speed end of the same plot

shows that tripping the boundary layer did have a significant effect on the airplanes maximum speed. Reducing the surface deterioration reduced the maximum speed by nearly 9 knots. This is a significant increase in drag of approximately 20%.

Referring now to the data of Long-EZ N26MS, a definite shift in elevator position is apparent at all normal speeds. After collecting the clean data the aircraft was trimmed to 100 knots 'hands off'. Then, without changing pitch trim, it was landed, the tape applied, and the fuel burned was replaced to keep cg and gross weight identical. It was then flown back to 100 knots. Data shows a 2 1/2 degree shift in elevator position and the pilot reported a 1 1/2 lb. pull force. Then, without changing trim, the aircraft was flown to 110 knots where it was again 'hands off' i.e.: no stick force. Note that the force was the same (zero) even though the position was 2.2 degrees different.

The minimum speed at 53 knots was unaffected by transition. This does not agree with earlier data from Long-EZ N79RA in which a 9 knot difference was measured. This points up the importance of recognizing that relatively small changes in contour (particularly with the GU canard airfoil) can adversely effect the transition characteristics.

Turning now to the Solitaire data, the pilot of the Solitaire could not feel any stick force trim change when operating between clean conditions and flying through rain showers. The transition elevator data, however, do show a minor trailing edge down trim change at speeds below 63 knots and trailing-edge-up trim change when faster than 63 knots. Remember, however that this is elevator position rather than stick force data and the changes seen here were not significant enough to be noticed by the pilot. As in the VariEze the minimum speed achieved when the surfaces were deteriorated with grit and tape were approximately 2 knots faster. The gliding performance was degraded considerably when the boundary layer was transitioned. The data shown are for powered flight with the self launch engine running at a constant power. A similar change is experienced during gliding flight except that the transition trim change "cross over" speed is reduced from 63 knots to 60 knots. With power off, the minimum speed achieved on the clean Solitaire is within 1 knot of that achieved with fixed transition. Note that the Solitaire has a relatively high amount of longitudinal stability in that the elevator position changes rapidly with speed changes. This condition results in a large elevator deflection (approximately 6 to 8 percent) required for normal thermalling flight. This results in a trim drag that reduces

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thermalling performance. Some fine tuning of the aerodynamics and cg range is being considered in order to see if improved thermalling performance can be achieved by reducing the large elevator deflection.

Referring to the Defiant data, tests show that with identical trim settings there was no stick force change due to fixed transition. Interestingly, the minimum speed with tape applied was less, probably due to the fact that the wing was more effected by the transition than the canard. This would result in a higher trim angle-of-attack.

We recently read an unpublished article written by a retired NASA engineer, which claims that all canard-type aircraft have a strong nose down trim change when encountering rain and that this characteristic may generally be dangerous. The article also interpreted the strong stable break in the pitching moment characteristics of the tandem wing airplanes as a "undesirable deficiency in elevator effectiveness at low speeds; rather than the desired characteristic of natural stall limiting that results in the safe flying qualities achieved by most of these airplanes. Due to the large number of errors in this unpublished article, the editors did not publish it. However, the author has succeeded in spreading rumors about these characteristics that some have attributed to our homebuilts. The author of the article has not flown any of the aircraft and had made some speculation based on reported results of other types that apparently do have strong or possible unsafe trim changes in rain conditions. In his article he even goes on to caution a pilot from pulling back on the stick in rain for fear that the nose will drop sharply. These characteristics, of course, are not seen in our homebuilts. As you see from the adjacent plots, the nose up positive elevator required to reduce speed is achieved at all conditions up through the flight conditions at which the aircraft's nose 'bobs' or 'bucks'.

Rain or no rain, the VariEze, Long-EZ or Solitaire can be maneuvered at normal speeds from base to final turns without fear of insufficient control power.

An analysis of the flying qualities resulting with fixed position should always be done during the flight test program of any new design, be it a canard, tandem wing or a conventional tail aft configuration. This is a relatively simple test to do. It is done by simply applying a strip of masking tape approximately 1/4" to 1/2" wide down all the leading edges, (top and bottom) at approximately 5% of chord. The effect on stability and maneuverability of the Long-EZ or VariEze due to this transition will be noticeable but not serious. For example, Mike and Dick both do low altitude aerobatic maneuvers with their Longs in driving rain conditions and notice only that a higher force is required to complete a given high-g maneuver. The take-off performance in rain is degraded in rain conditions, particularly at forward cg. much as it is on a conventional aircraft.

The following information is also interesting to note: The airplanes which exhibit a stronger nose down trim change in rain are generally found to be those that require too much trailing-edge-down elevator to trim in the clean (no rain) condition. One Long-EZ who reported a strong nose down trim change in rain, corrected his canard incidence by increasing it by 1 degree (which brought the elevator position back into the proper trim range) and thereafter found that the rain induced trim change was greatly reduced. You would think that if a very small contamination of the surface caused by a few bugs or rain would cause a noticeable trim change, a large change would be experienced when the aircraft accumulated large build ups of airframe ice and icing conditions. The opposite is true, ice has been accumulated on the Defiant and Dick's Long-EZ airframes without producing trim changes. Stall speeds increase, of course, similar to conventional aircraft.

The GU type airfoils used on the VariEze and Long-EZ are more susceptible to a change of lift due to rain than are more conventional,

lower lift sections. The GU-type airfoils are not low drag sections, however, and several attempts have been made to increase the performance of the VariEze or Long-EZ by the use of different airfoil sections. The original VariEze prototype N7EZ first flew with a NASA GAW-1 (now designated the LS013) section which resulted in unacceptable stall characteristics and a high stall speed. More recently some modern sections have been flown both with slotted elevators and with plain elevators on three different Long-EZs. None of those tests have indicated that a overall improvement could be achieved in the Long-EZ or VariEze due to an airfoil modification. Note that this does not apply to all tandem-wing types, it is quite probable that an airfoil improvement may be necessary or desirable on other aircraft which do not have sufficient control power at low speeds due to the transition of the boundary layer.

GRAPH OF VARIEZE N4EZ LONGITUDINAL CHARACTERISTICS OMITTED

GRAPH OF LONG-EZ, VARIVIGGEN, AND SOLITAIRE LONGITUDINAL CHARACTERISTICS OMITTED

GRAPH OF DEFIANT LONGITUDINAL CHARACTERISTICS OMITTED

New EZ First Flight

We have not reported first flight names since CP 32. The following list is those who, based on our information have made an EZ first flight. If you know of someone who should be on the list, please send us the name, address, N-number and date of first flight.

VariEze First Flight

RAY LITTLE	N2CRR	CA
BRYCE RINGSDORF	N37993	OR
HARRY DAVIS	N3262D	OK
BOB PAULSEN	N339EZ	CA
JOHN KEVERN	N222JK	NY
MIKE TOZZE	GEMMY	ENGLAND
FRANK HARRIS	N305Q	VA
ROBERT DEMALIGNON	N77AX	AZ
TOMMY THORNHILL	N3252	TX
DR. STITH	N1050G	CA
RON MENZIE	N718RM	AR
TROY EDWARDS	N1WX	CA
PIERRE MARCOTTE	CGMEZ	CANADA
RAY LAROCQUE	N1344Z	FL
JOHN CREEL	N4UM	CA
LARRY PRAVECK	N42231	OR
JAMES SNYDER	?	IL
WILL MCGREAHAM	?	CA
HANS SUCKSCHWERDT	DEEZP	GERMANY
BILL SEIBOLD	N6VE	AZ
FRANK POPLAWASKI	N60P	TX

DAVE BOLDENOW	N203DB	IL
ROBERT WAGNER	N533VE	IA
WARREN MARTIN	N75VE	CA
DAVID ROBERTSON	N45DR	OH
JIM SKILLING	N23EZ	CA
LARRY FREEMAN	N17LF	OR
EARL HILDEBRANDT	N711EJ	GA
DAVE SOLLISH	N625EZ	CT
DAN HUMMEL	N79DH	PA
CRAIG GOTTSCHANG	N30CG	GA
IRVING ARNOLD	N2260Z	DE
BRUCE OLSEN	N30LY	WA
LLOYD MACDOWELL	N1182Z	CA
BUD FOSTER	N503VE	MS
RALPH HALLENBORG	N141JR	CA

Long-EZ First Flights

CHUCK BUSCH	N143CL	CA
JOHN SHEFFELS	N682S	MT
DAVIS/WALLACE	N711QA	CA
MAX OVERHOLTZER	N141	CA
GRAY/GRAY	N553K	CA
GERALD COLLINS	N197GC	GA
WILLIAMS/CORTNER	N95JV	MN
JAN VAN NOORD	N7VV	CA
CHARLIE GRAY	N555LE	FL
RODIE RODEWALD	N1344T	HI
DENNY PARK	N291P	TX
PROUTS	N81KP	CA
KEN CLUNIS	N345KJ	CA
ROGER WARREN	N812EZ	FL
LUKE ROOSMA	N1378X	IL
SCOTT TWITCHELL	N31349K	CA
JACQUE CIVETTA	FPYOF	FRANCE
JUDGE KING	N350JK	MN
PAUL SCHNEIDER	HBYBW	SWITZERLAND
BRENT BRISTOW	N73BR	CA
DEBBIE IWATATE	N455EZ	WA
SAM MCCASKIE	N824SL	CA
GEORGE CUNNINGHAM	N3153N	CA
FRANK TIFFT	N307EZ	CA
HOWARD LEE	N373JH	CA
JO OSTRY	N21DQ	FL
JIM HIGHTOWER	N234LE	MS
GEORGE SCOTT	N486DS	TX
ROBERT FOREST	N82CZ	CA
ROBERT LABONTE	?	NH
CHARLES AUTON	?	FL
MYRTON LERSTANG	?	FL
NORMAN HOWARD	?	CA

From the desk of Jim Weir - Radio Systems Technology:

"NO ANTENNA FOIL ON THE GEAR LEGS. NONE, NO HOW, NO WAY. Get the idea? There have been a series of reports that the gear-leg antennas work very well when first installed, then gradually deteriorate over

time. Actually, the "deterioration" seems most pronounced after a hard landing. The copper foil is not as resilient as the glass, and rather than flexing like the fiberglass, copper tape breaks. Net result - lousy antenna operation.

Instead of copper tape, use a copper braid similar to Radio Shack 64-2090 (use 2 strips side-by-side) or Belden 8664. Every bit as good, but slightly harder to make, is to strip the black jacket from RG58 coaxial cable, remove the polyethylene/copper center conductors, and flatten out the resulting braid. Install this on the gear leading edge or trailing edge, not at the maximum thickness, to avoid flex failures.

For those of you who have a broken antenna, I recommend removing as much foil as possible - - both elements of the dipole - - and glassing braid on the OPPOSITE leg. It would be a major job to strip the glass from the broken glass and remove it, so I suggest you just leave it alone.

Actually, if I was a-buildin' the airplane, and I didn't have the wing and winglet glassed yet, I'd go ahead with a winglet antenna like the Long-EZ has for the COM antenna.

Jim Weir"

CP35, Page 5

On new construction VariEzes the "Long-EZ" comm antenna can be installed on the winglet and outboard wing as shown. Follow the instructions in CP 26, page 7 for the Long-EZ comm antenna.

Incidentally Jim recently checked the performance of a Long-EZ winglet COMM antenna and it's radiation pattern proved to be quite exceptional, much more uniform than the factory builts.**SKETCH OMITTED**

BUILDER HINTS
Canopy frame construction - VariEze and Long-EZ.
The following optional method includes several revisions to the plans procedure that make the canopy frame easier to build:

Cut out and locate the plexiglass canopy onto the fuselage per the plans. Using gray "duct tape" as a release, protect the fuselage longeron full length from the F28 to the firewall. The F28 bulkhead and firewall bulkhead should also be protected with gray tape.

Now working with 2 inch thick urethane foam scraps about 12 inches long, fit them all around the canopy per plans. They should be a reasonable fit to the canopy and to each other. Do not use micro to "glue" these blocks to each other and to the plexiglass, rather use Liquid X 40, foam-in-place (or an equivalent 2 lb/cubic ft "pour-in-place"-foam). Mix up small quantities and paint the liquid into the gaps and joints until the "frame" is securely bonded to itself and to the plexiglass canopy. Within an hour you can carve the frame to the required shape per the plans. The "pour foam" joints will carve and sand almost as easily as the urethane and a whole lot easier than micro joints. Glass the "frame" per Long-EZ plans:

1st ply - BID at 45 degrees overall (F28 to firewall)
2nd ply - BID at 45 degrees overall
3rd ply - UND lengthwise, sides only
4th ply - BID at 45 degrees front and rear only
5th ply - UND lengthwise, sides only;
UND side strips should lap 3 inches onto the front and rear BID.

Allow this layup to cure for 48 hours, then Bondo lumber stiffeners to the canopy frame per plans and remove the entire thing from F28 to the firewall. Turn it upside down and support it well on two saw horses. (Use Bondo to hold it firmly). Carve the inside (including all hard points per plans) and layup the same glass schedule as used on the outside, full length from F28 to the firewall. Allow this to cure for 48 hours, then you can cut the front and rear covers off per plans. These edges can be treated in a variety of ways, flox corners and ply of BID is fine. Several builders have made lapped or joggled edges using dry micro for a more weather proof joint.

Mike recently installed a "drip tray" around the front cover to canopy joint, which really does a job on keeping moisture out of the avionics, even in driving rain. **SKETCH OMITTED**

This is tough to install as a retrofit but can be done easily at the time of the original construction.

Canard Construction - VariEze and Long-EZ
Builder support on canards has been quite heavy, particularly in regards to getting the leading edge foam core bonded to the shear web, on the two inboard cores, in the correct position, vertically. If this is bonded on too low (relative to the airplane) the result will be a hollow lower spar cap and a bump in the top spar cap. This bump in the top cap is a problem, since it cannot be corrected. If yours is this way, our experience has shown that a small error here can usually be accepted provided a good job of filling with dry micro and fairing is done. The worst of this problem will be buried within the fuselage under the canard fairing block and usually will not extend much more than 10" to 15" outboard of the fuselage sides. A bump of up to 1/16" at the fuselage side, tapering to nothing at B.L. 25 each side, has not been detrimental to flying qualities.

A method we have used to eliminate this problem is as follows: Hot wire cut 4 canard cores. Before cutting the leading edge off the two inboard cores, obtain 6 pieces of wood dowel 1/4" diameter, 6 1/2" long, sharpen one end to a point just as you would sharpen a pencil. **SKETCH OMITTED**

Insert these dowels equally spaced into the trailing edge of the two inboard cores as shown. Push them into the foam, twisting them with your fingers. They should protrude beyond the shear web cut line about 1 1/2". Now pull the dowels out and hot wire cut the leading edge foam cores at the shear web. **SKETCH OMITTED**

Jig the inboard cores, and layup the shear web per plans. After this layup cures, drill 1/4" holes through the shear web in 6 places where the dowels will go through (use a flashlight to locate the holes). Now bond the leading edge foam cores to the shear web per plans, using

micro. Paint micro onto the dowels and push all 6 of them in, until they are flush with the aft face of the canard. Complete the canard per plans. The dowels will guarantee that the leading edge foam cores are perfectly aligned and your spar troughs will be correct top and bottom. We recently built a canard using this method and ended up with a really nice contour, top and bottom, with no bump or hollow place in the spar cap area. Try it, you'll like it!

Spark Plugs
The new Champion REM37BY plugs are approved for both the Lycoming 0-235 and Continental 0-200. On the 0-235 L2C they are highly desirable due to the excessive lead fouling in these engines. For VariEze builders with close tolerances between cowling and spark plugs, the REM37BY plugs are 3/8" shorter than the standard REM40E plugs, which can mean the difference between having to install blisters on the cowl or not.

VariEze and Long-EZ CHT
On these airplanes, with "updraft" cooling, when we measure CHT at the spark plug base, if we install the temperature probe (washer type) on the bottom plugs, which is usual, we are measuring over 40 degrees less than the temperature on the top plug. So keep in mind that if you have a marginally high CHT and are measuring at the bottom plugs, you may even be over the red line. For the record, Lycoming does not measure CHT at the spark plug base. All published data on Lycoming CHTs are taken at the threaded hole on the bottom of each cylinder head. When possible, this is the preferred pick off point.

Detecting Fuel Tank Leaks
Most leaks can usually be detected by the tried and tested soapy water method. Occasionally however, a persistent small leak may exist that simply will not show up with soapy water. These leaks are probably located in the forward face of the

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centersection spar, or on the fuselage side. A sure fire method to locate these leaks is to use a "Freon Gas Sniffer". These expensive gadgets can usually be borrowed from your local friendly auto airconditioning repair man. Simply spray a little Freon into the offending tank, pressurize it by raising the altimeter no more that 1,500 feet. The Freon Sniffer will quickly locate the leak. If the leak is inside the centersection spar, you may have to cut through a CS5, CS6, CS7, or CS8 bulkhead. Cut a plug no bigger than you have to, to get your hand through. Cut the plug out at an angle so the plug can easily be floxed back in place. **SKETCH OMITTED**

Repair with two plies BID lapping at least 1" onto the remaining pane. Now that you have the exact location of the leak, you can suck a 1,500 ft. lower than ambient pressure, causing a slight vacuum. Paint warm epoxy over the leak area, working it in with a brush or rag. Do this for a couple of minutes. Then open the tank to ambient pressure. This is most important, since the epoxy that was drawn into the leak, would continue to be drawn in until the leak was once again there. You want the epoxy to cure in the leak area. Incidentally if you intend to install position lights/strobes and/or antennas in the wingtips, you will need holes in the CS5, CS6, CS7 and CS8 bulkheads to run the

wiring and coax through from the wings to the fuselage. A maximum of a 2" diameter hole may be cut through the center of each bulkhead.

Engine Vibration
Occasionally a builder/flyer will call with a mysterious engine vibration. Our own experience in this area has included, prop balance (never assume even a new prop will be in perfect balance), spinner not running true, baffling touching the cowl (the aluminum, not the neoprene asbestos, which obviously must lap onto the cowl), exhaust system touching the cowl, and one more we had not seen before which Nat Puffer sent in, the hose clamp around the intake manifold rubber sleeve (Lycoming 0-235) was touching against one of the lower dynafocal engine mount donuts. This was not apparent at rest, nor did it occur at run up. Once the engine was turning up a high power, the torque was twisting the engine enough to touch at this point. The result was a high frequency vibration, that was extremely annoying, even worrying.

Cutting Glass Cloth
Marc Boram sent in this hint for easy cutting of glass cloth, both UND and BID. Marc uses a regular utility knife which is sharpened on emery paper before and during each use. The key to success is a large piece of sheet rock as a backing board for the fiberglass. The knife is pulled across the glass at a very shallow (5 degree) angle, with just enough pressure to cut slightly into the surface of the sheet rock board.

A straight edge is useful for holding the glass in place for straight cuts, but is not absolutely necessary. For curved cuts, lay out the patterns on the cloth with a felt tip pen, then cut them out with the utility knife. Good conservation of cloth and extremely rapid cuts are the result. Sharpen the knife blade often, and remember you can use both sides of the sheet rock.

Caution: Small strips of the cutting surface may contaminate your cloth, so inspect carefully and change your cutting surface often. Glass cloth must be kept absolutely clean. If it is ever exposed to water it must be discarded.

Sterling Primer
We are still using and recommending the Sterling Primer filler. While a few builders have reported experiencing problems, our own use of the material has worked well. The two part material should be thoroughly mixed at a 50:50 ratio. DO NOT wait. You have only about 30 minutes of pot life. Either paint it on with a brush or spray it on. Do not leave it in your spray equipment for too long. This is a urethane material and if it sets up in your spray gun, that will probably be the end of your gun! One of the problems we have seen with Sterling has been pinholes. Dick Kreidel sent the following suggestion - do not use a cheap suction spray gun, these seem to produce many pinholes using the Sterling. Use a good quality spray gun such as a Devilbiss JGA502 with a pressure pot. Use fluid tip and needle "FF" with a #704 air cap. This is a very large orifice on the fluid tip and the #704 air cap provides a 12"-14" fan. The advantages of using a large fluid tip is that you need very little air atomization pressure to move a lot of paint. The best combination is 15 to 20 PSI on the pressure pot and 25 to 30 PSI on the air atomization. A big advantage of low air atomization is that the overspray is almost not existent. Most of the

paint stays on the work. We were able to spray Sterling, mixed with up to 25% by volume with micro balloons.

Sterling can usually be sanded within an hour, compared to over 6 hours when using feather fill.

Epoxy Ratio Pumps - The manufacturer of the ratio pumps Michael Engineering, has asked us to pass on the following information regarding regular maintenance.

The check ball on the hardener side should be cleaned every 6 to 12 months. It is located just behind the brass fitting on the front of the pump body. The hardener tends to 'plate' onto the ball, which causes it not to seat perfectly. This allows hardener to drain slowly back and it may not flow on the first stroke of the pump at the next use. Simply take the fitting off, clean the ball, spring and fitting. Another option is to "coin" the seat by putting the ball in place and striking it gently with a brass punch and hammer. This will assure a perfect seal. Be careful that the spring does not caught in the threads when reassembling pre-1981 models.

Remember to subtract the weight of your containers before calculating the ratio, when checking your pump ratio.

FROM THE BUILDERS AND FLYERS
First flight from Debbie Iwatate.
"Long-EZ N455EZ flew for one hour on it's first flight October 31, 1982. It went so smoothly that we found ourselves thinking, "is that all there is to it!", after the landing. A big reason for having an uneventful first flight was our friendship with Bryan Giesler (VariEze 90331). By the time we were ready for flight testing the Long, I had accumulated almost 15 hours of back seat time and 3 hours of solo time in his aircraft ..... that does wonders for a persons confidence! The only changes we have made to the plane are to change to REM37BY plugs, modify the upper brake arm (BA) to make it an inch longer to increase the braking effectiveness, and change the pitch trim spring lengths to gain more nose down trim authority. I have flutter tested up to 198 mph IAS, stalls are at 60 mph engine idle (straight forward and smooth) and 55 mph power on. We are burning about 4 - 4 1/2 gallons per hour average.

It took us about 2,000 hours to build the plane (325 for the finishing) and that was spread over 21 months. We didn't cut too many corners on cost and our final cash outlay was around $18,000 (well worth every penny). Many thanks to you Mike, for your assistance every time I called for help.

Incidently, the nose (side) airvents work very well! Leading the air into the cockpit through eye-ball vents, we are getting fantastic ventilation. In addition we added "extra air" vents on the sides above the CC spar "deck".

We have 33 hours on the plane now and have been signed off by the FAA. Now we can settle into the maintenance routine and get our fly-in schedule made up for the summer of '83. Many thanks to Burt for making such a project possible to folks like us.
Take Care, Debbie Iwatate".

Debbie is the first female builder/flyer to complete and fly a Long-EZ. Congratulations!!!

FROM THE BUILDER/FLYERS
Paul Williams and Max Cortner write that they have over 150 hours on their Long-EZ, also known as "White Lightening". Max is planning on a honeymoon trip to the Bahamas this month and Paul will be flying it to Phoenix in February. Paul recently had a scary incident - pitch control disconnect in flight! Happily he landed uneventfully using the pitch trim system for pitch control. They had had the canard off to seal around it and when it was replaced, the clevis pin was pushed through from the outside, horizontally toward the center, so that the safety pin was easier to install. What they think happened was that the safety pin caught on the pilot's pant leg and was pulled open. The pin eventually worked it's way out due to being oriented horizontally and the pitch control system was disconnected.

This is a very serious thing, we should all be aware of. First of all the clevis pin should be oriented vertically and should be installed from the top so gravity holds it in place. Secondly a piece of gray tape wrapped around the safety pin will stop it vibrating and protect it from inadvertently being opened. One school of thought would be to install an AN3 bolt and locknut in place of the clevis pin. After all, how often do you remove the canard? In any event this connection should be on everyone's preflight checklist.

ACCIDENTS AND INCIDENTS
The CP Newsletter reports accidents and discusses their conditions and causes, for information purposes for all operators. We have always investigated accidents in the interest of determining information that we can disseminate to you to prevent recurrence. It should be recognized in our discussion of accident conditions or causes that generally this information is preliminary since it is published before the availability of the FAA accident report.

From Bruce Tifft, B & T. Propellors
"Bonnie and I have always enjoyed writing articles for the CP and the Hospitality Club Newsletter about our wonderful trips and adventures in our VariEze. This article is not fun to write, but necessary. We feel it is very important to share experiences - good and BAD.

Our VariEze has been destroyed in an accident that occurred on November 20 at Santa Paula Airport. I was checking out a very good friend in the front seat of the EZ. Al is a top-notch pilot and is retired Navy with thousands of hours in all-types of aircraft. In fact, he checked out both Bonnie and me in different airplanes. As you can tell, he is a very competent pilot and one I did not hesitate to let fly the EZ from the front seat. Now, as many of you know, Santa Paula is a terrific little airport, but is notorious for it short runway (2,500), obstacles and obstructions at the end of the field, and unusual wind conditions at times. We have operated our EZ out of this field for over 4 years and thus far never had any problems. Burt has always warned about operating out of such a short field with the EZ. For 4

years we had no problems, however, when we needed that little margin for unusual conditions, it wasn't there! On this particular Saturday, we encountered a very severe wind shear, (a phenomenon that Santa Paula is also famous for). The airplane performed as usual, but we went from a substantial head wind to a tailwind. Just after lift off, the EZ fell back to the ground with all three wheels. Not too many options were available - couldn't abort and couldn't gain sufficient altitude to clear the obstructions. Al navigated us through a very thin "eye of a needle" space. We went under some telephone lines and barely over a house. The landing gear clipped the very upper portion of the roof of the house, and the left wing collided with the T.V. antenna. This dropped the nose just enough to miss electrical wires carrying 440 volts.

Under the wires, a cable T.V. coax one inch in diameter went over the pitot tube and around the canard and stayed with us turning us around 180 degrees. The airplane impacted the ground on the spinner and flipped almost inverted. Al remained in the front seat, and I was thrown through the canopy. Dragging this huge cable slowed the plane sufficiently to allow us to escape with our lives and relatively few injuries. We also attribute our survival to the incredible strength of the EZ. We feel sure if we had been in a conventional airplane we wouldn't be here to write this story. Also, there was no post-impact fire, a fact that again saved my life since I was saturated with gasoline. We would also like to pass on our thanks to Jack Hooker at Hooker Harness Company. Al's seat belts were intact, and he had to release them to get out of the plane. I was thrown from the plane on impact, but my seat belts held through all that crashing around and when they did fail, actually pulled part of the fuselage with them. The shoulder harness attach straps were bent up past 90 degrees. Certainly can't beat that for strength. Only one engine mount extrusion failed at a bolt hole, the mount itself let go. The airframe has been demolished, however, the Lycoming rep feels sure the engine is still useable and the front cockpit are pretty much intact. The radio and most of the instruments are still good. Al sustained a nasty cut on the back of his head, cut behind his left ear and miscellaneous cuts, bruises and aches and pains. I cracked my pelvis in two places, broke a rib, bruised a long, had gasoline burns on my back and under left arm and a burn on my left hand from pushing away from the exhaust pipe, also a nasty blow to left kidney and shoulder. However, we are feeling very lucky to be here.

As far as our B & T Propeller customers, I have been slowed down a bit from all this, however, I am back in the shop (with the help of a cane) and will get your props to you as soon as possible. Would appreciate any time you can give me if your project isn't ready to fly.

It was heartbreaking to lose our beautiful little airplane, but we have received so much support and expressions of caring from so many people that it really pulled us through this tragedy. Bonnie and I have often talked about what a terrific life-style we have enjoyed since having the EZ and all the wonderful people we have met and made friends through it. Our very deep appreciation and gratitude goes out to all of you who helped us through this difficult time (especially Mike and Sally Melvill, Les Faus, Frank and Margie Tifft).

Now, to end on a happy note . . . we have made arrangements to buy a very good friend's Long-EZ project. Chuck Gardner has modified the fuselage somewhat, but it is still basically a Long. Chuck has done impeccable work and we are thrilled that he will let us take over his project. Chuck was sensitized to the epoxy and felt he could not work on the plane, but had put so much hard work and love into it, he wanted to see it finished and flying. We'll work together on getting this accomplished. So, we will have another EZ flying before too long and join in again with all the fun and happiness that goes along with owning one of these terrific airplanes".

Comment: EZ builders/flyers operating over normal gross weights and out of short airports, take note!

A Southern California VariEze flyer/builder crashed into the bay on short final at Palo Alto, during a night approach. A critical nut and bolt which had not been installed correctly came loose, causing the airplane to suffer a pitch control disconnect. The VariEze was completely destroyed by the impact with the water at approach speed. The pilot suffered a serious back injury but was able to swim to shore.

A California VariEze pilot was fatally injured when his recently completed VariEze crashed. Eye witnesses reported hearing the engine missing, then finally stopping. The aircraft banked into a right turn, which rapidly developed into a tight spiral. Just prior to impact the engine roared into life. The aircraft was destroyed by fire after the crash. The accident is under investigation. Cause has not been determined.

A VariEze crashed on its first flight in Southern Indiana. The builder/flyer was fatally injured. The following report is from the pilot of a chase plane. "He was in no hurry at all to fly. Did not intend to fly. Took off, looked good, well under control, climbed to about 300 feet. Used runway 04. I was in a Luscombe. The VariEze made shallow turns, when he got on downwind, it was obvious that he was descending. His

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turn and descent continued until he clipped the top of a low tree (30 ft) and then hit the ground. The airplane broke up, pilot was thrown out. Fire broke out about 5 seconds after the impact. Flight was not erratic and I feel that maybe something happened to the pilot, since he never made any recovery motion at all, did not retard the throttle at all to impact nor did he try to level the wings, nor did he try pull up. He was about 59 years old."

Prop Windmill and Forced Landings
An EZ's prop will windmill at flight speeds above 65 to 70 knots. However, while practicing slow-flight or stalls at 60 knots or less, if your engine's idle is set too low, or you run out of fuel on one tank, the engine may not only quit running, but the prop may stop. Should this happen, and you do not have a starter, keep calm, switch tanks, verify mags on and mixture rich. Push the nose down and build up at least 135 knots (155 mph). The prop will begin to windmill at 125 to 135 knots and the engine should start. A windmill start uses less

altitude if you initially dive steeply to rapidly attain the 135 knots. If you are faced with a forced landing for any reason, pick out a smooth spot and execute a NORMAL landing. Extend the nose gear and speed brake and land as if you were on your home field, DO NOT try anything fancy. Make a normal landing. If there are obstacles in the field, guide the fuselage/cockpit between them.

Turbo Chargers and EZs
This subject is starting to come up more and more lately. Review - first, RAF does not recommend a turbo charger on a VariEze or a Long-EZ. These aircraft, when operated within the normal envelope and at normal gross weights are probably the last aircraft to need a turbo charger. They are excellent high altitude airplanes having the capability to climb well over 25,000 feet. Turbo chargers and their associated parts are heavy, 20 to 25 lbs for an average installation. This is right on the tail, absolutely the worst possible place to add weight.

A turbo charger installation without a constant speed prop is self defeating. If you keep your standard prop, your engine will over rev at altitude. If you install a larger prop to take advantage of the additional horsepower available at altitude, your engine will not be able to turn up enough RPM static, and you will have marginal, possibly even dangerous take off performance. Remember your turbo will not help at lower altitudes, (unless you overboost - a certain way to destroy your engine).

For acceptable take-off performance, you must be able to turn at least 2400 RPM static, (2500+ RPM is better). Constant speed props are not recommended at all. Weight, complexity, initial expense, maintenance cost, and unreliability while running in the wake of the wing/centersection are excellent reasons not to fool with these props. Use good judgement - the simple, lightweight, wooden, fixed pitch props have a good history and with care and attention to checking bolt torque at required intervals, can give long, reliable service.

Avoid First Flight with 'Zero-time-type'.
When your EZ is ready for first flight, relax, take stock, be honest with yourself. In this day and age there is no reason for a person to have to do a first flight "cold turkey". There are enough of these aircraft around now that there is little excuse not to at least get a back seat ride. If you do not feel confident, get an experienced VariEze or Long-EZ pilot to do your first flight. Do not let pride get in your way. Having an experienced EZ pilot do your first flight is very often the smartest move you can make.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LONG-EZ PLANS CHANGES

LPC #108, MEO, Section IIL, pages 7 and 13.
The brake master cylinder is shown mounted on the inboard side of the CS73 bracket on Page 7, which is correct. It is incorrectly shown outboard of CS73 on Page 13.

LPC #109, MEO
Add the following to the parts listed on page 2-1 of the Long-EZ plans under "custom prefab parts" by Ken Brock Mfg.

Lycoming exhaust system
Dynafocal engine mounts
Conical engine mounts
A484 back up rings (4 required 2 each)
JI.25 axle nuts (2 required)
LE2-LL landing light mount kit
LMBG1 forward main gear attach brackets (2)
LMBG2 aft main gear attach brackets (2)

LPC #110
Add the following to the Owners Manual, page 22 under "Engine Out"
"A windmill start uses less altitude if you initially dive steeply to rapidly attain 135 knots"

Clarification Plans Change LPC #82, CP 30, page 9. This has been causing some confusion. This change was simply to clarify the orientation of the one ply BID called out in Section I, page 5-2. This ply is not an addition. It goes full span along the longerons and laps onto the inside skins 1/2", and should be at 45 degrees to the longeron, not at 90 degrees as some builders have tried to install it.

VariEze Owners Manual Change.

Add the following to the Owner's Manual, page 19, under "Engine Out":

"A windmill start uses less altitude if you initially dive steeply to rapidly attain 135 knots".

SHOPPING

The Long-EZ lithograph, shown on the back page of CP 33 is available from RAF. This drawing was done by the well known aviation illustrator, Jim Neuman. It is a must for anyone building a Long-EZ. It is printed on heavy linen paper. The price is $10 which includes postage and handling. California residents, please include 6 percent sales tax.

RAF has T-shirts in stock. We have pale blue and cream shirts with a Long-EZ and the logo "Laughter Silvered Wings" for $8.00. We also have the white T-shirts with a cartoon type EZ on its nose with the logo, "I fly a nose dragger", at $7.00. All the shirts come in adult sizes, small, medium, large and extra large. Some children sizes are also available. The ladies shirt in both types is the french cut style. Don't forget to let us know your size and color preference.

We have the Long-EZ and VariEze silver belt buckle in stock in both the rectangular shape and oval - small and large in both. $25 each.

Byron McKean's Compuflight is now available as an integral unit or as a remote mounted unit ready to install, including the "gizmo". Write for an order form.
Basic Compuflight $229.95
Remote Compuflight $259.95
Contact:
McKean Systems Inc.
Route 1 Box 429-B
McQueeny, TX 78123
512-557-6575

Batteries for VariEze and Long-EZ

We have recently tried a manifolded battery made by Yuasa General in Reading, PA, called a Yumicrom battery. It is supposed to last 4 years if properly cared for and puts out a lot of power for its size and weight. Mike has two, part # YB14L-AZ, 12 volt, 14 amp batteries in his Long-EZ, which is a 24 volt system. They easily handle the load of starting the O-235 Lycoming. In the Solitaire, we use a part #YB16-B, 12 volt, 19 amp which would also be excellent in a VariEze or Long-EZ with no starter. We obtained these batteries with a neat battery charger from:

Cycle Battery Supply,
8104 South Freestone Ave.
Santa Fe Springs, CA 90670
213-698-2211

The battery charger is pocket sized, plugs into 110 volt AC like a calculator charger, and features a snap connector that eliminates reverse connections, that is wired permanently to the battery.

The electric aircraft cabin heaters such as the one Mike has been testing in his Long-EZ, are now being manufactured and sold by:

Dolphin Marketing Ltd.,
9999 South 248th Street,
Kent, WA 98031
206-859-1999

Cabin Heat
These are excellent heaters, small, lightweight and reliable. Mike gave his a good test a few weeks ago when he climbed to 23,000 feet to do some fuel flow testing. The temperature was -25 degrees C and yet he says his feet were quite comfortable.

The most important thing is to seal every little gap where air might blow in, as best you can. Make a cover to go over the top of the nose gear crank mechanism, between the NG30 bulkheads (2 plies BID). Seal around the canard to fuselage juncture, using RTV silicone. Seal the gaps fore and aft of the elevator torque tubes with soft sponge rubber, glue it to the canard and fuselage with RTV silicone. Be certain that there is no interference or friction with full elevator travel. Most important, you battery must be the manifolded type and it is mandatory that it is vented overboard. For 12 volt systems the 20 amp model will probably be best for most, while for 24 volt systems, the 16 amp model is fine. Mike uses a 24 volt, 16 amp model, since his Long-EZ is 24 volt. When using this cabin heater you must have at least 20 amp (10 for 24 volt system) alternator output above other drains.

FOR SALE

Factory fresh Lycoming O-235-L2C specifically built for Long-EZs.
Contact: Norm Bender
P.O. Box 30343
Memphis, TN 38130
901-794-0032

In the crate, new Lycoming O-235-C2C, 80 octane $6500.
Contact: Bruce Tifft,
8746 Ventura
Ventura, CA 93001
805-649-2721

1978 Lycoming O-235-L2C complete. 320 TT since new. $4900. Engine has been nitrited and all AD's complied. Call Tracy - 805-822-4668.

Lycoming O-235-C2C - 1540 TT. All accessories.
Contact: Big Sky Aircraft
P.O. Box 538
Lewiston, MT 59457
406-538-8150

Lycoming O-235-C2C - 1466 TT. All accessories except flywheel.
Lycoming O-235-C2C - Zero since major, complete
2 Continental O-200 - Zero since major, complete
Contact: Frank B. Johnston
Box 32245
San Antonio, TX 78216
512-494-6608

Lycoming O-235-C - 36 hours SMOH, complete. $3700
Contact: Gary Klippenstein
Box 533
Altona, Manitoba, Canada ROG OBO

Wes Gardner is still selling his excellent, reusable foam air filters. Wes has some other neat "EZ" items. A retrofitable fuel sight gauge, for those with poor translucency in their gages and an oil separator system that takes the place of the starter cover on an O-200 Continental and this is guaranteed to remove all traces of breather oil mess on your cowling. Wes is still working on a similar one for the Lycoming engines. Mike will be installing it shortly on his Long, N26MS. Contact Wes for more information:
Wesley Gardner
1310 Garden St.
Redland, CA 92373
714-792-1565

Original VariEze main gear and nose gear struts.
Contact: Harlan Wilhelm
P.O. Box 87
Post Falls, ID 83854
208-765-6027

Collins transponder, model TDR950 T50 Class IA, brand new, never used - $600.
Contact: Eugene Schreckengost
Ridgecrest, CA
619-375-2064

Neal Johnson is updating his excellent plans changes/builder hints index to include CP35 and additional builder hints not incorporated in the last issue. Price is $8.50
Contact: Neal Johnson
1011 South Grand St.
Monroe, LA 71201

VariViggen News.

Sunday the 28 November '82, I visited with Charles Cowan and Bill Campbell at Rialto Airport, where they had their new Viggen N82VV, (see photo) ready for it's first flight. After a little problem with mag wiring, we got it running well and I went out and made the first flight. It flew just like the other Viggens I have flown, except it was down on power (later traced to mag timing). I did not retract the gear on this first flight so was unable to look at the high speed end of the scale. Congratulations to Bill and Charles.

We have been doing quite a bit of flying in 27MS lately in relation to some laminar flow testing Burt needed. It was most interesting to note that no trim change at all was noticeable to the pilot. N27MS has accumulated 575 hours to date. The original prototype N27VV had just

over 600 hours when retired to the EAA museum. Arthur Schwartz has over 200 hours on his Viggen. Looking at our records, we show a total of 15 VariViggens having flown. It takes a long time and a lot of determination to build a Viggen!

The list of Viggen builders who wish to share information and experiences has grown to 17. This list of names is sent to each of the builders on the list. If you are building a VariViggen and would like to have your name, address and phone included on this list, let us know. We update the list at newsletter time and it is mailed out to all those on it.

The amount of feedback we receive from Viggen builders is virtually zero. A builder called the other day and was really upset that we devote most of the Newsletter to the Long-EZ and VariEze. The biggest reason for a lack of Viggen news is a lack of builders interested enough to get back to us. We have asked for builder/flyer input and the results have been disappointing. If you want more information in this CP, send it in.

For Sale - Viggen project - contact:
Carroll Holzworth,
P.O. Box 26,
Ft. Morgan, CO 80701
303-867-2487

For Sale - Viggen project - contact:
Tom Gierhart,
916-459-3456 - Work
916-459-5329 - Home, after 6 pm

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

From Switzerland, Paul Schneider's Long-EZ, now flying. Looks like a basic IFR panel. Note Space Saver Panel on the right.

Bill Campbell (standing) and Charles Cowan's new VariViggen, N82VV, ready for first flight. What? Two Viggens on one airport ?!?!

Dan Hummel's beautiful VariEze N79DH

From "Down Under", Victoria, Australia. Jim Glinderman's idea of what a Long-EZ instrument panel should look like. Note circuit breakers on left console.

From England, Ivan Shaw's instrument panel. Registration: G-IVAN!

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Burt and Mike preparing Solitaire for a flight at the SSA contest in Tehachapi.

Bull Durland and Gordon Boyer, all major structure completed.

Einar Enervoldson conducting a weight and balance on Solitaire before a performance test flight.

Dick Pretice cut a hole through his garage wall to solve the problem of installing both wings at the same time in a single car garage.

Mark Borom. Got the main gear on!!

Debbie Iwatate - first flight of her Long-EZ.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.1ft
Area	94.8 sq. ft.
Empty Basic	750 lb.
Empty Equipped	800 lb.
Solo Weight	1000 lb
Gross Weight	1425 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	600/950 ft
Climb (solo/gross)	1750/1250 fpm
Cruise 75% 8000 ft	186 mph
Cruise 40% 12000 ft	146 mph
Top Speed - Sea Level	193 mph
Max range * 75% (solo/2 place)	1380/1150 mi
Max range * 40% (solo/2 place)	2070/1690 mi
Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 full size drawings. It includes many photos, over 800 drawings and 65,000 words. The builder is led step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components. A video tape is available covering all aspects of building the moldless fiberglass/foam sandwich construction. The tape covers the latest methods used to obtain the optimum weight, strongest fiberglass lay ups. This presentation will help both the first-time and experienced builder and attain quality aircraft workmanship.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction for the complete engine installation, including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

A video tape is also available which covers the weight and balance procedures, taxi tests and first flight.

LANDING BRAKE - Complete full size drawings for the landing brake device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail to U.S. & Canada	Overseas Airmail - U.S Funds
Rutan Aircraft Information Package - complete data and photos of all Rutan designs.	$ 8.00	$ 9.00
"Canard Pusher" newsletter Published quarterly. One year subscription. Approx. 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIL Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50
Long-EZ Landing Brake	10.00	11.00

6% Sales Tax, if Calif. order.

Newsletter not taxable.

The following are RAF-authorized distributors of Long-EZ materials and components. Contact the distributors at the addresses below for their and description of items.

ALL RAW MATERIALS AND PREFAB FIBERGLASS PARTS

Near Los Angeles
AIRCRAFT SPRUCE
201 W. Truslow, Box 424
Fullerton, CA 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT
401 Pine Street
Highland, IL 62249
(618) 654-7447
Catalog $3

Prefab machine parts such as, control system parts and welded parts, fuel caps, engine mount, rudder pedals and exhaust systems.
KEN BROCK MANUFACTURING
11852 Western Avenue
Stanton, CA 90680

(714) 898-4366
Catalog $3

Main and nose gear, fuel strakes, fuselage bulkheads.
TASK RESEARCH INC.
848 East Santa Maria
Santa Paula, CA 93060
(805) 525-4545

Canopies are available from RUTAN AIRCRAFT.

RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Jim Hemingway's VariEze seeing daylight for the first time!

THE CANARD PUSHER NO 36 APR 83

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Overseas (Airmail)	$8.75
Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 36. If you are building from 2nd Edition plans you must have newsletters 18 through 36. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 36. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 36. If you are building a Long-EZ you must have newsletters from 24 through 36.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 4:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

Aircraft on Display at RAF
We have on display at RAF two Long-EZs and the Solitaire. We are often asked why the Defiant and the Grizzly are not available for viewing. Two reasons - first is that there simply is not enough space, if we would get Grizzly in the hangar, that would be all that would go in!! Second is that the Grizzly and Defiant were not designed as homebuilts, only as research and development aircraft. Building a research and development aircraft every once in awhile is necessary so that RAF can test and try out new materials and methods that will benefit the next homebuilt.

During 1983, RAF will be closed for three-day weekends on the following dates:

May 30	Memorial Day
July 4	Independence Day
Sept 5	Labor Day
Dec 24	Christmas

RAF ACTIVITY
Since the January newsletter RAF had a trip to the Annual Sun 'n Fun flyin at Lakeland, Florida. The Solitaire was shown with the retractable engine at the Soaring Society of America's convention in Reno, Nevada. The doors were installed on the Solitaire and much work has been done toward preparing the distributors for the Solitaire program. Mike and Sally's Long-EZ made the cover of Technology Illustrated magazine. Builder support and Saturday demos continue as usual.

SUN'N FUN - 1983
Mike Melvill and Michael Dilley attended the Sun 'n Fun for the last two days of the show. The weather was less than optimal, it rained so much that the afternoon airshow was held only on Wednesday, Friday and Saturday. In spite of the weather 32 EZs flew in during the week, 23 VariEzes and 9 Long-EZs. Unfortunately Irene (Mom) Rutan was unable to attend so we do not have all the pilot's names.

An excellent IVHC dinner was held at Christina's Smoke House hosted by the EZ Builders of Florida. There must have been well over 100 people attending. A high light of the evening was Charles Gray presenting a Birthday cake to Charlie Auton for his 80th birthday. Charlie has a student pilot's license and has recently completed his own Long-EZ. Charlie flew it into Lakeland. He has about 6 hours on it so far and says it is much easier to fly than the other "spam can" trainers he has flown!

The "Michaels" gave a Solitaire and Long-EZ talk and slide presentation which were both well attended. Walking up and down the rows of EZs and meeting with and talking to the owners was lots of fun as always.

Tim Gehres sponsored the annual EZ race. Three Long-EZs and three VariEzes were entered. Herb Sanders won at a blistering 200 mph speed over the 51 mile course.

For the last two days, the weather cleared and the flybys were in full swing allowing the "Sun 'n Fun" to live up to its name.

Reno, Nevada - Soaring Society of America's Convention
Sally and Michael Dilley drove the van towing the Solitaire in a borrowed sailplane trailer up to Reno with Burt and Mike flying up the Sierra Nevada mountains in the Defiant. What a sight - tons of snow.

Solitaire was put on display in the convention hall in the MGM Grand and was well received by the 2500 or so Soaring enthusiasts attending. The electro-hydraulic engine/prop extend/retract system was given a thorough workout with literally dozens and dozens of cycles, demonstrating it for four days.

The SSA convention was a success and we were pleased with the reception given to the Solitaire. Quite a few sailplanes were on display, including a couple of self launching models. Both of these cost in excess of four times the cost of a Solitaire. Burt gave a talk on Solitaire and we were very proud the he received the "Exceptional Achievement Award" from the SSA at the Awards Dinner.

LONG-EZ COMPLETES TESTS AT EDWARDS AIR FORCE BASE, CA
We are pleased to announce that the United States Army has built 2 Long-EZs at Fort Lewis, Washington. One of these Longs has recently completed a comprehensive static load, ground vibration test and flight test program at Edwards Air Force Base. The Army is studying the Long-EZ with its all composite construction to see of the design can be applied to future Army aircraft. Test pilots, Major Don Underwood and Major Robert Ward both agreed that the handling characteristics of the Long-EZ were very good.

Both Long-EZs will be involved in an evaluation program starting in May of 1983 and lasting approximately 6 months. This is to determine the feasibility of using the latest civilian technology in a military environment.

(Does this mean that we can park our "replicas" with the War Birds at Oshkosh ????).

SOLITAIRE
Solitaire is now complete. The KFM engine folds in and out with two doors closing over the engine when it is folded away. We use an electro/hydraulic pump to raise and lower the engine/prop assembly. We have 10 hours on this configuration with no problems.

Two people can easily put a Solitaire together or take it apart in under 10 minutes. Solitaire should fill a void in the spectrum of aviation, in that the average private pilot can build one for between $7000 and $9000, including engine, but not including instruments or avionics. He can then store it on his driveway in a relatively small trailer, thus no hanger or tiedown rent. He can drive it to his local airport, remove it from the trailer, assemble it himself (using a wing stand) or better yet with the help of another person. He can then strap in, switch on the master switch, extend the engine and start the engine using the electric start.

Taxiing is an absolute delight. It is done on the two main tires and one wing tip wheel or once you are up to a brisk walking speed, you can raise the wing tip to wings level, and taxi on the mains. The nose wheel is steerable. The rear wheel has a small hydraulic brake. It is easy and lots of fun to taxi. The take off is simple, no mags to check, engine running, full throttle and you are ready. Ailerons keep the wings level, nose wheel steering and rudder keeps Solitaire pointed down the runway. Acceleration is reasonably quick. It will rotate at around 35 to 40 KIAS and lift off shortly thereafter. Climb out is best at 40 to 45 KIAS. Climb RPM is 5800 to 5900 RPM. CHT should not exceed 350 degrees F. The prototype will lift off in 600 to 800 feet.

Mojave is at 2800 MSL and density altitude this time of the year runs around 3500 to 4000 feet. Rate of climb is about 400 ft/min initially and this tapers down to 200 ft/min at 9000.

Once you are high enough, throttle back to idle and kill the engine with the ignition switch. The prop will stop if you are below 60 KIAS. Pull out the red knob which actuates the prop centering cam, the prop will windmill gently onto the cam. Flip a switch to retract the engine. It will fold away and the doors will close in about 7 seconds. Now you are in a 32:1 sailplane and even if you have never done so before, you can enjoy the quiet solitude of soaring. If conditions are good, even a neophyte may be able to gain a little altitude.

As you descend back down through 1000 feet above the ground, extend the engine, crank it up and enter the pattern just as you would in your favorite "Wichita Wonder". The spoilflaps are very powerful and allow excellent glide path control. With experience, full spoilflap is extended on downwind, opposite the numbers. The nose is pushed over to hold 60 KIAS. This speed is held until you are on short final, then by varying the spoilflaps, you will be able to touch down at 35 to 40 KIAS and roll to a stop in 300 to 600 feet. Or you can close the spoilflap and push in the throttle for a touch and go!! Lots of fun, touch and goes are not normally practiced in a sailplane but are easy in the Solitaire and very good practice to enable you to get used to the spoilflaps. Taxi back to your trailer (no need for a ground crew) and refuel or disassemble and off for home. Solitaire has a fuel capacity of 5 gallons, so you could fly with the engine running for over an hour and a half. This is not the purpose of the Solitaire. The engine is simply a replacement for the tow plane and it gives you the freedom and flexibility to soar where and when you want to, independent of expensive tow planes.

Plans - As with the other homebuilts that RAF has done, RAF will be supplying the plans and builder support. Licensed distributors will handle the kits. Plans for the Solitaire will be available June 1, 1983. The owners manual and engine installation will be available August 1, 1983.

Task Research has done all of the tooling for the prefabricated glass parts and are the approved distributor for prefab fuselage shells, main wing spars, turtle deck, seat pan and canopy in it's frame. In addition to the above basic kit, Task Research intends to provide as an option prefab bulkheads, fairings, wing tips, engine cover doors and possibly hot wired foam wing cores.

Contact: Task Research Inc.
848 East Santa Maria
Santa Paula, CA 93060
(805)525-4545

Ken Brock Mfg. will have all pre-machined metal parts including brackets, bellcranks, weldments, mounts, hinges, latches etc. Available either as a complete package or as individual parts as needed.

Contact: Ken Brock Mfg.
11852 Western Ave,
Stanton, CA 90680
(714)898-4366

Aircraft Spruce and Wicks Aircraft will have all of the raw materials, cables, nuts, bolts, washers, foam, glass and epoxy necessary to complete your Solitaire.

Aircraft Spruce	Wicks Aircraft
P.O. Box 424,	410 Pine Street,
Fullerton, CA 92632	Highland, IL 62249
(714)870-7551	(618)654-7447

PREFAB PARTS FOR SOLITAIRE

The following is from Task Research, the Manufacturer of the prefab parts for the Solitaire and Long-EZ.

"Essential Kit": so called because RAF has chosen to not supply drawings or information for these parts to be homebuilt. Fuselage shells are fully formed half shells made in molds with preimpregnated epoxy glass cloth and Nomex honeycomb core, vacuum bagged and oven cured. Assembly will be easy because the edges are formed with a double joggle like so: **SKETCH OMITTED**

To make it easy to fit and then bond together using clecos or pop rivets and flox and then when cured, taping the joint as specified in the plans. All the molds are taken from one master pattern so all are coordinated with each other for fit. All necessary reference marks are scribed in the molds and transferred to the parts. Final trim and installation are left to the builder. Plywood or solid glass inserts are included and glass to glass edges are formed. It will be necessary to add some reinforcements where they are required in the construction sequence. You will note that each component may be purchased separately and is priced accordingly.

Wing Spars: Wing spars are manufactured in Class A metal molds and have the metal fittings attached. The spar caps are pressure molded in heated molds that assure proper size and density. Shear webs are wet layups and the spar final size and shape is controlled by the mold. Should you ever need a replacement, you can be sure that it will fit as well as the original one.

Frills: We have listed all the parts that you have the information to build yourselves as "Frills". The advantages of getting these parts preformed are (1) time savings; they are ready to trim and install. (2) Weight savings; prepreg epoxy glass parts will weigh about 15 percent less than the same wet layup parts. Task Research and RAF's intention is to develop components to help you build your Solitaire with the same quality as the finest glass sailplanes and motor gliders.

Pre-impregnated glass fiber with epoxy resin is purchased from Hexcell Corp. and is kept in cold storage 35/40 degrees until used. It is then laid in the mold with the proper core materials and core adhesive, and to the correct lay up schedule, placed under a plastic bag and sealed. A vacuum is pulled to compress the entire sandwich against the mold. Next it goes into the oven for curing at 215 to 250 degrees. The end result is a very strong light weight structure.

Nomex Honeycomb, the same material as is used in many aerospace products is an Aramid Fiber/Phenolic resin product. Task Research Inc. uses it in the Solitaire because it makes a lighter stronger shell than any of the foam cores.

Film adhesives are used between the pre-preg cloth and the Nomex Honeycomb as a bond enhancer to guarantee the highest strength shells. It is a partially cured adhesive film on a throw away carrier film.

Foams - PVC or Clark Urethane is used for bulkheads and other flat or light contoured parts.

Spar caps are made from S-2 glass roving (strands). Made from the same glass roving as the Long-EZ landing gear. First it is wet out to the proper percentage of resin to glass then packed in heated metal molds for curing. Both pressure and temperature are regulated. The spars consist of completed assembly with core and shear webs. They are jigged and drilled to fit. This allows later replacement if one wing is damaged.

Caution! - Pseudo Fiberglass Cloth
It has recently come to our attention that a cheaper 'version' of our UND #7715 cloth is available from a different major weaver. We obtained a sample of this glass and admit that our first impression was favorable. By just looking at it, it was virtually identical to the original #7715. We cut equal size pieces and weighed them on a gram scale. Weight was identical. We did a few sample layups to check wet out and the ability to layup around a tight radius. Again essentially the same performance. We felt we had something we could recommend.

We then decided to do a simple flexure test of this new cloth comparing it directly with our original UND. The test consisted of 24 coupons of each type. We failed all of them and plotted the results. We faired a line through the 24 points to obtain an average. The result was startling. The new cloth was 19 percent weaker at ultimate load and 31 percent weaker at initial failure. See the graph below. **GRAPH OMITTED**

NOTE: The really confusing aspect of this is the fact that the weaver of this cheaper material saw fit to call it by the same part number #7715.

This means that if you were to use this material to build your VariEze or Long-EZ, even though you may have excellent workmanship with optimum resin to glass ratios, you would still have an airplane that could suffer a structural failure at only 81 percent of the expected load capability. Worse than that, the initial failure point (first noise) would occur at only 69 percent of the normal expected load. This is not acceptable since it would be impossible to detect initial failure occurring in flight. It could sneak up on you. Do not take this lightly. If you have purchased UND glass from any source other than Wicks Aircraft and Aircraft Spruce, you almost certainly have the wrong glass. Spruce and Wicks have been the only source of the correct UND, due to proprietary rights. If you have built any major structural

parts (wings, winglets, centersection or canard) from this glass, you should discard them.

EPOXY REACTIONS

A small percentage of our builders continue to develop allergic reactions to the Safe-T-Poxy. Applied Plastics, the manufacturers of the epoxy continue to try to isolate whatever it is that causes this problem. It is not an easy task. Safe-T-Poxy was recently retested by an independent lab and again came up with an SPI rating of zero, on a scale of 0-10. Applied Plastics has published an excellent brochure covering all aspects of using epoxy, precautions to take and what to do if you react to it. They also evaluated the various types of gloves that are on the market. They have a brochure that very thoroughly covers this subject. It turns out that the only glove that is an absolute 100 percent barrier is one made of Butyl. Butyl gloves are expensive but Applied Plastics has found a reasonable one that will last a long time with care and still gives good feel. Some people are effected by contact with the material, others by inhaling the fumes. A good quality respirator with charcoal filters will go a long way toward curing the latter problem. Again Applied Plastics have found a very nice disposable charcoal filter which they have in stock.

Write to Applied Plastics and enclose a SASE for the brochures and prices of the Butyl gloves and respirator. See page 7 of this CP.

No one at RAF has developed an allergic reaction to either the old RAE epoxy or the Safe-T-Poxy. We are always careful and after every layup we wash our hands and arms very thoroughly using Lava soap. Mike Melvill has been using Vaseline brand "Dermatology Formula Lotion". He uses it morning and evening whether or not he has worked with the epoxy. Mike has been working with the various epoxies RAF has recommended for 9 years and is a firm believer in washing after short layups and even during large layups. Different techniques may be required for different individuals. Cotton liners under vinyl, rubber, latex or butyl gloves are an excellent idea. These absorb the sweat. Do not apply Ply 9 as well as wearing gloves. Ply 9 works quite well by itself, but the barrier it forms, (which is impenetrable by epoxy) can be ruptured while working. If you suspect this has happened or if a glove is torn, stop. Take the time to wash your hands, dry them and reapply Ply 9 or a new pair of gloves.

Take care of yourself while building. A few builders have simply had to give up their projects due to severe reactions. Do not think it won't happen to you. Everyone has a level of tolerance at which their body will cry 'uncle', don't try your luck.

PROP EXTENSIONS

As described in CP 30, page 5, the 6 inch prop extension has continued to provide trouble free operations. We have sufficient time on these extensions on two Long-EZs here at RAF to feel confident in recommending the 6 inch extension as well at the 3 inch extension.

Note that we have only tested these on Lycoming engines. Due to the smaller crankshaft diameter of the Continental engines and the lack of data, we cannot recommend anything but the thoroughly tested 3 inch extension for Continental engines.

The 6 inch extension does reduce the noise level in the pilot's seat by as much as 3 decibels (DBA scale). However it also increases cylinder head and oil temperatures slightly. The worst case is a new or recently overhauled engine, in a new airplane. It is possible that engine temperatures could go out of acceptable limits during the first few hours of operations, especially during ground testing. We have noticed on an engine with hundreds of hours, that if we are forced to run the engines standing still on the ground for extended periods of time, in excess of 30 minutes or so, the cylinder head temperature can climb right to the red line. Using a 3 inch extension this will not occur.

To summarize: We recommend both the 3 inch and 6 inch prop extension for the Lycoming engines and only the 3 inch extensions for the Continentals. You, the builder must decide which to use in your application.

CP36, Page 3

Unintentional Spin in Homebuilt - Long-EZ N711QA

As you know, our Long-EZs have undergone extensive high angle-of-attack testing at all cgs and configurations and the results have shown them to be immune to stall, departure or spins. Vigorous and sustained combinations of all flight controls were input, by us and by a NASA pilot with the same results. The Owners Manual does caution, though that experience has indicated not all examples fly the same and that the builder should be aware of differences. We have recently heard from a Long-EZ owner who has experienced a spin and his report is published below. It is possible that he was operating aft of the aft limit cg. His impression of the effects of power for recovery are probably due to the oscillatory effects of the incipient spin since it lasted only two and a half turns. Conclusive data on power effects can only be made after a stable (developed) spin rate is achieved (over 2 or 3 turns) and by study of flight test instrumentation-obtained data. See also our LPC #115 on page 6.

Pilot Info: Age 63, 30,000 plus hours, flew Aeroncas, Cubs, Monocoupes, Cessnas, Stinsons, Wacos, Fairchilds, Douglas DC 3-4-6-7-8, Boeing 747 etc. Currently own half interest in a Pitts S-1, Long-EZ and a 1927 Monocoupe".

"Conditions - Gross weight 1070, Fuel 84 lbs left tank and 42 lbs. right tank, CG - maximum aft, altitude 3000 ft, SL - 2200 ft above ground, WX - CAVU.

While approaching a stalled condition with the nose about 15 degrees up, air speed 62-65 mph, the left wing went down about 60 degrees followed by the nose dropping and the airplane entering a left spin. The nose was at least 60 degrees down. After the spin had started, an attempt to recover was made by using forward stick and opposite rudder. There was no response. Opposite aileron was also used which may have aggravated the situation. The aircraft had a rather rapid rate of rotation - faster than a Citabria type but less than a Pitts S-1. Also there was pressure to the right - being pushed against the right side of the cockpit. With no response from basic control inputs the throttle was "jabbed" which resulted in a momentary slower rotation

rate. When the engine idled back, the rotation returned to its original quite rapid rate. The throttle was then opened (1/8 - 1/4) and left there. The spin rate decreased and a recovery was effected. The pull out from the dive did not result in high air speed. The actual speed was not observed: however, the G load was not excessive - less than the bottom side of a loop with the airplane.

The number of rotations was about 2 and a half and 800 to 1000 feet of altitude lost. After climbing a few thousand feet a half hearted attempt was made to duplicate the situation, but it was unsuccessful.

With the many times that the almost identical flight conditions have been explored that is the only time this condition ever surfaced or gave any indication that it might surface. The airplane has about 180 hours on it and flys and performs beautifully.

Approaches to stalls have been very normal and docile. Usually a wing will drop (30 degrees at the most) followed by the nose dropping, and then wings can be leveled with either rudder or aileron. During this incident no attempt was made to level the airplane until the resulting spin was entered.

That the gyration was a tight spiral does not seem logical for a couple of reasons. From past experience with spins and spirals, had the airplane been spiraling considerable speed would have built up and basic control would have been regained. Also the pull out would have had much more speed.

As to the effect that the engine had on recovery, one wonders whether it was the thrust that aided recovery or the resulting torque, or both.

The only change to the aircraft since the original flight test is the addition of wheel fairings. It would not appear that they would cause appreciable change in flight characteristics particularly at such low air speeds.

Sincerely, Paul Wallace.

Paul reports that he installed 10 lbs of lead in the nose and his Long-EZ now flies at full aft stick per the book.

NOTE: When doing the original envelope expansion on your new Long-EZ, wear a parachute and have at least 7000 feet of altitude. If you find yourself routinely operating at aft CG, ballast to around mid CG. Any aircraft flies better at mid CG, a little lead up in the nose does not hurt a thing.

N26MS - Mike and Sally's Long
With 521 hours on the Hobbs, 26MS is running like a dream and continues to prove what a reliable high speed transportation machine a Long-EZ is. I recently got tired of my combination 12V/24V system which never did work correctly. I cut the front cover over the instrument panel off and rewired the airplane to be a 100 percent 24 volt electrical system. It was intimidating thinking about how I was going to do this, but once started it was actually quite simple to do. I have also installed Wes Gardner's fuel sight gauges (see CP 35 page 10) and must say I am pleased with the result. Also installed Wes's oil separator

breather and it has worked great! No more cleaning cowling after landing.

A few weeks ago a photographer from "Technology Illustrated" took a bunch of slides of my Long-EZ for the cover of the May edition. He wanted to light up the inside of the cockpit. He handed me a remote controlled flash unit with quite a heavy power pack. Like a dummy, I laid it on my lap, not tied down. In the middle of the photo session, I hit a strong bump, the flash unit sailed off my lap and crashed into the canopy cracking it badly just in front of my head. It cracked almost clear across with a hole a couple of inches square. It scared me but once I slowed down and pulled the cracked pieces back into place, I found it to be no immediate problem and was able to complete the mission.

Sally temporarily repaired it by laying up a huge fiberglass patch both inside and out. At least we could fly until the new canopy came in. Actually went to the IVHC Agua Caliente flyin this way! I talked to Dan Patch and Phil Cornelius, both of whom had been through repairing a broken canopy.

First we cut the plexiglass canopy about 1 inch above the rail all the way around (son Keith did the work, I supervised!). This removed the broken canopy. We turned the frame over and cut through the fiberglass just inside the edge of the plexiglass lip. This allowed us to peel out the fiberglass piece that fitted the original plexiglass bubble exactly. This thin glass "frame" was carefully layed into the new "bubble" and was used to layout where it should be trimmed in order to fit. While I cut the new bubble, Keith broke out the remaining plexiglass with a vice grip, a hammer and wood chisel and a dremel grinder. The plexiglass does not come out easily. After the frame was cleaned up, the new bubble fitted almost perfectly. We floxed it into the frame and let it cure over night. Next morning, I trimmed and sanded. I microed in all the voids and the layed up two plies of BID over the plexiglass up onto the inside of the frame. I let this gel up for a few hours, then reinstalled the whole canopy/frame onto the airplane. I locked it down and let it cure for two days. This assured that it would fit the fuselage. Later I removed it, cleaned it up and sprayed the charcoal Zolatone inside the canopy frame. I did not have to repair the outside frame. The new canopy gives me a little more head room (not all canopies are alike!) and the visibility without the fiberglass patch is superb!!

FROM THE BUILDERS
Don Foreman from England (one of the builders of the first VariEze (G-LASS) to fly in the UK, is about ready to fly his Long-EZ (G-RAFT). Don has installed a Continental O-240, 130 hp. by Rolls Royce. His empty weight is 847 lbs with starter and alternator. As of this date (April 14) Don has run his engine and will be at the airport within two weeks for taxi testing and flight testing.

George Allison of South Africa reports the first flight of his Long-EZ (ZS-USS) in January '83. George is a first time builder and completed his Long in good time.

His biggest problem was getting parts from the USA. George installed a Lycoming O-235-C2C and a B & T prop. Congratulations!

Homer "Mac" McClanahan (N326OT) and George Kelley (N326OK) both from Long Beach, California built their Longs together. Their Longs weigh within 1 lb of each other, were both ready to fly at the same time and the latest two Longs to fly. Congratulations Mac and George.

We received the following letter from Long-EZ co-builders, Bob LaBonte and Dick Dorman:

"Dear Folks at RAF,

Just a few words of thanks for the great design you produced in the way of the "Long-EZ". The plans are very well written and quite simple to follow. This is the first plane we have ever built and we are extremely happy with the results.

N31542 flew for the first time on Sunday, September 15, '82 while we were conducting our second day of high speed taxi tests. That first flight lasted for 45 minutes and flew hands-off well within the trim range. Our ship has an O-235-C turning a Ted Hendrickson 62 x 66 prop and has an empty equipped weight of 824 lbs. The performance is close to specs with no wheel fairings. We completed the project in 23 months.

We wish to thank all the people at RAF who have been so helpful on the phone and at the airshows whenever we needed assistance. Your builder support program is unquestionably one of the keys to the success of the EZ program.
Sincerely, Bob LaBonte and Dick Dorman"

CAFE 400
This year's efficiency race promises to be just as exciting as ever. If you have never entered, you should. It is quite a challenge and most rewarding.

The event consists of an approximately 400 statute mile closed course flight competition for propeller driven aircraft weighing less than 6500 lbs.

Awards will be given to the aircraft with the highest score according to the CAFE formula which is:
Speed X miles per gallon X payload.

The race will be held at Santa Rosa Air Center, Santa Rosa, California on June 24 and 25, 1983. An entry fee of $50.00 is required for each aircraft.
Contact: Brien Seeley MD
CAFE 400
4370 Raymonde Way
Santa Rosa, CA 95404
(707) 526-3925

INTERNATIONAL VARIEZE HOSPITALITY CLUB FLY-INS
1. Brookridge Air Park, IL April 23, 1983

Contact - Buzz Talbot - (312)985-5264
- John Steichen - (312)985-6671

2. Jackpot, NV July 4th weekend
Shirl Dickey, 1646 Allegheny Drive, Murray, UT 84107, is organizing a IVHC flyin at Jackpot NV. A motel is close by and is $36.75 per night per couple. Camping is available 100 ft. from the airport. On Sunday, Shirl would like to have an EZ race from Jackpot to Wells and back, 118 statute miles. There will be 4 classes based on horsepower. Ribbon cutting and spot landing contest on Saturday and possibly a golf and tennis tournament depending on the interest. There are 3 casinos within walking distance of the motels and airport. Shirl is planning a banquet on Sunday evening - prime rib for $10.50 per person. Please contact Shirl if you are interested, especially if you would like to enter the race. Contact - Shirl Dickey (810)268-3360

3. Wallowa Lake, OR July 16 & 17, 1983
Contact Ray & Nova Cullen (503)963-2202

4. Ruth, CA Sept 2, 3 & 4, 1983
Contact Barbara Wilson (916)726-7456

The IVHC is dedicated to promoting hospitality, travel and support for EZ pilots and builders. If you would like to join, please send $6.00 domestic or $8.00 overseas to - IVHC, 2531 College Lane, La Verne, CA 91750.

Dr. Paul Adrien (Long-EZ N46AA) is interested in developing IVHC activities in New England. He invites all EZ builders and flyers to the Concord, New Hampshire airshow on Saturday June 25th, "83 for a "get-acquainted" flyin - drive in. For more information contact:
Paul Adrien,
18 Hearthstone Rd.
Pelham, NH 03076
(603)635-3061
(617)682-5656
Please reply by June 18, 1983 if you plan on attending.

2nd Annual EZ fly/drive Picnic
Date 23rd April, Saturday, Noon to 5 pm.
Place: Brookridge Airpark (private airport) southwest of Chicago in Downers Grove.
Contact: John Steichen
960 86th Street
Downers Grove, IL
(312)985-6671
Last year 30 people attended including several EZs from out of state.

EZ CLUBS
Dayton area (Ohio) VariEze and Long-EZ builders have formed a Hospitality and Co-op support organization called "DUCK". This stands for "Dayton United Canard Klub". Local area builders should contact:
Michael Zimmerman,
7313 Dabel Ct.
Dayton, OH 45459
(513)435-0882

"DUCK" will be organizing a flyin in connection with the Dayton Air Fair in July 1983 and will hold monthly meetings.

Long-EZ Squadron #1.
This is a club for Long-EZ builders only.
Contact: Long-EZ Squadron #1
Chino Airport,
7000 Merrill Ave,
Chino, CA 91710

Long-EZ Squadron #2
A second Long-EZ builder/flyer club is starting up at Santa Monica airport with aims similar to those of Squadron #1. A builder's support club to provide assistance by builders to builders. Those who have Rutan registration numbers are welcome to join. The club plans to develop assistance committees, a newsletter and lectures. If interested, please contact:
Long-EZ Squadron #2
3021 Airport Ave.
Santa Monica, CA 90405
(213)398-5652
(213)454-9877

EZ Builders of Florida
This club was run by Charlie Gray, now organized by Jim Carlin. For more information, contact:
Jim Carlin
5359 Lantana Road,
Lake North, FL 33463
(305)964-3805

Claude Beaudet, a French Long-EZ builder would like to contact other French builders. Please contact:
Beaudet J. Claude,
33 Boulevard de Charonne
75011 Paris, France

The Educational Resources and Planetarium in Lumberton North Carolina has asked us to announce that they will show, upon request, the Rutan video tapes. That is the Construction tape, Flying is VariEze, Defiant and First Flight tape. For more information, contact: James Hooks at (919)739-3302.

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LONG-EZ PLANS CHANGES

LPC #111, MEO, Section I, Page 16-4
Universal joint CS120, should be MS20271-B10, not AN271-B10

LPC #112, MEO, Section I, page 9-1, top right
"Refer to Chapter 8" should read "refer to Chapter 14".

LPC #113, MEO, Long-EZ Owners Manual, page 32
Aileron mass balance - it reads "level to 10 degrees nose down", should read per Section I page 19-9 bottom left - "The aileron must hang between the angle that makes the bottom surface level and the angle that makes the top surface level after painting".

LPC #114, MEO, Section I, page 32-3
Gear and canopy warning wiring diagram. For clarification add the correct call outs for each connection to each switch, i.e. C (common), NO (normally open), NC (normally closed). See sketch pg 9.

LPC #115, MAN-GRD, Long-EZ Owners Manual, page 20, Bottom of the page add - "Builder experience has indicated that it may be possible to spin a Long-EZ when at or aft of the aft CG limit. Analysis indicates that the spin mode or recovery would not be effected by power. Recovery should be forward stick, rudder against rotation and ailerons neutral or with the spin rotation".

BUILDER HINTS L/E (Long-EZ) V/E (VariEze)

V/E & L/E: Straight edges for hotwire cutting foam blocks to the correct planform. Buy an aluminum 36" yard stick from any hardware store. Drill a #30 hole (or to fit your nails) at each inch in the center of the yard stick. Cut it into two 18" lengths and you have the very best pair of hot wire cutting straight edges.

V/E & L/E: Fuel tank vents icing over - none of us should fly into icing conditions. However, if it should happen to you inadvertently, it is possible to have your fuel tank vents clogged by impact or rime ice. This could cause your engine to quit! The remedy is to drill a #50 hole on the aft side of the vent tube per sketch. **SKETCH OMITTED**

L/E: Accessory case machining for fuel pumps/oil coolers. Vance Atkinson went to Hankcock Industries, 2551 Willow Street, Long Beach, CA (213)424-3795. This is a small father/son shop. They do good work at reasonable prices.

V/E & L/E: John Sheffles (Long-EZ N682S) reports that he recently was able to get his engine checked for vibration on a helicopter balancer. At 2000 RPM his Long-EZ had a reading of '3', about average for a light plane. By adding a nut and bolt of the correct weight at the proper location on the starter ring gear, this reading was reduced to 0.5! John reports a noticeably smoother and quieter airplane.

Any FBO with a helicopter rotor balancer should be able to do this, or stop by Great Falls airport, in Montana. "Rocky Mountain Air" can do the job for a reasonable price. All it takes is a couple of hours - sounds like a great suggestion John, thanks.

V/E & L/E: Phil Cornelius turned in this neat method of tracing a fuel tank leak. This assumes you have the fuel cap holes cut and have a small enough leak not to be detectable using soapy water. Push an ammonia soaked rag into the tank and seal the caps. (Phil bondo'd an aluminum cover over the hole). Then soak a rag in Phenolphthalein (C2O H14 O4) and hold it against the outside of the tank moving it around until you see a purple spot. This purple spot is your pinhole leak! Pop off the aluminum cap covers, remove the ammonia rag and vacuum the vapors out of the tank. Wipe down the outside of the strake with soap and water.

You should be able to scrounge a small baby food jar's worth of C2O H14 O4 from your local high school or college chemistry teacher. It it's in powder form, use alcohol to dissolve it into solution. CAUTION - Phenolphthalein is hazardous if it comes in contact with your bare skin. Use only with rubber gloves.

V/E & L/E: Gear up warning systems. It has come to our attention that several builders have installed the gear position micro switch so that it is contacted with the gear in the up position. This is totally unacceptable and is cause to ground your EZ until the switch is mounted such that the gear is down and fully locked when it contacts the switch. This is very important. You will have no warning if the arm has backed off from its safe over-center position.

SHOPPING

Available at RAF are the following items:

The Long-EZ lithograph, shown on the back of CP33. The price is $10.00.

T-Shirts are in stock. The "Laughter Silvered Wings" comes in two colors, blue or cream, $8.00 each. "I fly a nose dragger" is white with a cartoon EZ, these are $7.00. Both T-shirts come in Ladies small, medium and large. Mens are small, medium, large and extra large. Childrens are small (2-4), medium (6-8) and large (10-12).

Belt Buckles with either VariEze or Long-EZ in either brush or shiny finish. $25.00. These are made from German silver and hand made.

Posters - two kinds. Two ship Long-EZ are 11 x 17 at $2.00 each. Three ship Defiant, VariViggen and VariEze 17 x 22 at $2.75 each. Please add $1.00 for postage.

Long-EZ three view drawings are available for $10.00.

Solitaire three view drawing - $5.00 each.

VariViggen Radio Control Plans - $4.75.

The "Complete Guide to Rutan Homebuilt Aircraft" by Don and Julia Downie is available from RAF at $9.95.

The RAF patch - large $2.50, small name patches - $1.50.

Video Tapes. The Construction tape and Go-a-Long-EZ (first flight and weight and balance) are $59.95 each or $99.95 when bought together. Please add $4.00 for postage and don't forget to specify Beta or VHS.

Remember Californians to add 6 percent sales tax!!

Aircraft Spruce has the following new items available:
Electric cockpit heaters, same as Mike has in Long-EZ, N26MS, see CP35.

12V 14 Amp manifolded batteries Yuasha #YB14LAZ as called out in CP35.

B & D Tachometers, expensive but the best you can get, 2 1/4" electric, accurate, reliable, same as in Mike's Long-EZ N26MS.

Pizza Cutters, for cutting fiberglass, excellent. But must be used against a resilient material.

Wicks Aircraft Supply has a slightly different version of the throw over canopy stay. Made by a Long-EZ builder, Jim Duprey, these are complete and ready to bolt on.

Applied Plastics of El Segundo, California, (213)322-8050 has a supply of an excellent disposable charcoal filter respirators. Also pure Butyl gloves, a bit expensive but if you are having problems with epoxy reactions, this is your way out. Butyl is the only 100% barrier to all of the chemical components in Safe-T-Poxy.

Ken Brock Mfg. has just completed a run of throw over canopy stays per the drawings in CP30 and has them in stock.

NOTE!! Task Research reports that 23 sets of the 340 x 5 (small) wheel pants were delivered to Aircraft Spruce and Wicks with the left wheel pant incorrect. Contact Task direct for replacement. (805)525-4545.

Lycoming O-235-L2C still in the crate - $5700
Contact: Erwin Oertli
6186 West 10050 North
American Fork, UT 84003
(801)756-2864

Rusty Foster's Space Saver Panel
We recently got the opportunity to examine Rusty's latest Space Saver Panel Kit. It is excellent. The instruction booklet is very well layed out, clear, concise and also contains a lot of useful hints and ideas. We have seen several of these panels installed in both VariEzes and Long-EZs and they not only look great but they allow more efficient use of the instrument panel space.
Contact: Foster's Modular Design Co.,
P.O. Box 4941
Ventura, CA 93004
(805)642-6308

Byron McKean's popular Compuflight seen on more and more VariEzes and Long-EZs is available as a basic integral unit or as a remote mounted unit. Until July 1, 1983 prices will remain as follows:

Basic Compuflight	$229.95
Remote Compuflight	$259.95

After July 1, 1983 prices will be as follows:

Basic Compuflight	$249.95
Remote Compuflight	$279.95

Write to Byron for an order form:
McKean Systems Inc.
Route 1 Box 429-B
McQueeny, TX 78123
(512)557-6575

Retrofittable fuel sight gauges, PVC and 3/16" thick glass. Not only gives you a crystal clear view of your fuel, but also damps out the sloshing, making it easy and accurate to read fuel levels.
Engine breather oil separator for both Continental and Lycoming.
Contact: Wes Gardner
1310 Garden Street,
Redlands, CA 92373
(714)792-1565

FOR SALE

Continental prop by Ray Hegy 58 x 67
Contact: Gerald Gieszler,
Box 6073,
Great Falls, MT 59406
(406)761-6383

Lycoming O-235-C2C, 640 hours since new, logs, carb, mags and fuel pump. Partially disassembled for a top overhaul (valves and jugs done and ready for assembly). $2695 includes crating.
Contact: Danny Schultz
P.O. Box 823
Arcadia, FL 33821
(813)494-3118

Lycoming O-235-C1 zero hours since major, ready for Long-EZ, includes fuel pump, Slick mags and Brock mount.
Contact: Gordon Jones
4257 Findley Way
Livermore, CA
(415)447-1549

Continental O-200 total time 840 hours. Since major - 271 hours. Complete with Slick mags, Sanders Exhaust and prop extension. $3,990.

Also an original VariEze main gear, complete with axles, brakes, wheels and tires $495.00
Contact: Bruce Muirhead
458 Handicap Ave.
Pagosa Springs, CO 81147

VariEze original main gear strut, plus numerous assorted EZ parts. Also a factory new, in the crate Lycoming O-235-C2C.
Contact: Bruce Tifft
8746 Ventura Ave.
Ventura, CA 93001
(805)649-2721

VARIVIGGEN NEWS

Three more builders sent in their names to be added to the "Viggen Club" list. This brings the total to 32. A new update will be sent to all those on the list every news letter. The "Viggen Club" seems to be working quite well. Several builders have been writing back and forth and sending me copies. I am glad to see the Club working for the builder's benefit.

Wayne Wilkins reports that Peter Lawrence, who bought Wally Warner's Viggen, has completed the job of rebuilding and is flying. Congratulations Peter. Charles Cowan reports that his Viggen is flying well and he is enjoying his immensely. Charles has a Lycoming 0-360 180 HP and has found as I did on N27MS that his 70 x 70 prop was too much. He has cut 1" off each end and now at 75% power over a measured 20 mile course he averages 142.7 knots (163mph). This is roughly the same performance I get out of N27MS.

Terry Galbreath reports that he has been transferred to Thule, Greenland for 12 months which means putting his Viggen project in storage for that time. Terry has been making progress, bottom is skinned and painted through primer. Gear is in and operating. Terry

asked about rain trim change in a Viggen. Burt reports that his Viggen had no perceptible trim change even in very heavy rain. N27MS is exactly the same, no measurable trim change in light, moderate or even a cloud burst! Any other Viggen flyers care to comment?

Frank Stites reports his Viggen is nearing completion and he hopes to fly this summer. All composite parts are complete and painted white. Canopy is done and he is working on the cowling screen. Frank was over to look at Ken Guskott's Viggen which is complete through finish paint. Only the seats remain to be done. Jack Rosen is cutting foam cores and most of the non-composite parts are done.

N27MS has been doing quite a lot of flying lately and now has 601 hours on the Hobbs. This makes her the high-time Viggen. Burt's went into the EAA Museum with 600 hours. A close friend, Bruce Tifft of B and T Propellers from Ventura, California has been putting some time on my Viggen. I lent the Viggen to Bruce after he lost his beautiful VariEze in an unfortunate accident (see CP 35). Bruce has over 600 hours of VariEze time and had no trouble at all transitioning into the Viggen. He bases the Viggen at Santa Paula, a 2500 foot strip in Southern California and has no problem in operating routinely out of this strip. Perhaps Bruce would write us a report of his impressions of the Viggen as compared to his EZ? How about it Bruce? His wife, Bonnie tells me she loves it, it feels so solid and besides, with full dual controls, she can fly from the back seat!

I was at a flyin at Aqua Caliente a few weeks ago when I heard a familiar engine noise. It was a Viggen descending into the pattern. Bruce made by far the shortest landing of the day. It looked like a miniature Shuttle on short final. It gave me a strange feeling to see my Viggen fly into an airport without Sally or me in it!

Bruce has refinished my prop and installed his urethane "rain proof" leading edges. This type of leading edge on a wooden prop should be considered mandatory if you expect to get any sort of utility out of your airplane.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Wow! This one will take you back! Burt getting a little stick time in the original prototype Viggen circa 1972. This is one that started the "Canard Revolution".

Wayne Wilkins' Viggen - a different approach to the canopy. Pretty snazzy seats Wayne.

Walter Hudson's Viggen with dynafocal mount. Walter asks: "Do you think I should go to a 42" fan?"

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

The "Real" George Scott's beautiful Long-EZ instrument panel. Note - engine instruments and intercom mounted in the right forward baggage area.

Herb Sander's Long-EZ instrument panel. Herb managed to get it all on the panel - looks great.

Bijan Neshat has this auto license plate.

Henry Schultz of Glengowan, Australia getting some stick time. Workmanship look great.

Dr. Robert Forest's "side" panel. Engine instruments, circuit breakers, switches and even his stereo tape deck fit nicely, freeing up the instrument panel for flight.

80 years young, Charlie Auton built and flies this Long-EZ. Alright Charlie!!!

SCHEMATIC OF GEAR & CANOPY WARNING OMITTED

SOLITAIRE -
A
Self-Launching
Sailplane

THE PROBLEM
For a long time soaring has been an exclusive sport requiring a special license and training. Soaring in a glider of enough performance to allow the average pilot to feel the true thrill of 'engineless' flight has been expensive enough to severely limit the number of people who enter the sport. The current interest in ultralight and light sport aircraft has reached an all-time high.

THE CHALLENGE
The Soaring Society of America recognized the problem. Other segments of homebuilt aircraft were experiencing great interest and activity on the part of designers and the general public. The sailplane market was not getting its share of the attention. To correct this, the SSA issued a challenge in the form of a contest. Develop a self-launching sailplane capable of take off and the ability to climb to altitude without the use of a tow plane. The new design could be flown without the special license required of a sailplane pilot, just a private pilot's license. The aircraft must be easy to fly, as well as quick and easy to build. Strict rules were set up and an actual structural test of the finished aircraft was required. The Solitaire was designed around these goals and achieved these and more.

THE WINNER
At the flyoff held in Tehachapi, California, on September 6, 1982, the judges studied the entries, flew the SOLITAIRE and unanimously declared it the winner.

WHAT
The SOLITAIRE is a single-place self-launching sailplane that is fitted with an engine package that folds into the nose of the aircraft after it pulls the SOLITAIRE to soaring altitude. With the engine folded, it

has a L/D of 32 to 1 giving it true soaring capability. The engine can be deployed and restarted inflight using its electric starter. The canard concept results in high resistance to inadvertent stalls and spins. Its 'spoilflap' descent control system has been acclaimed as "excellent" by all evaluators, providing crisp, variable glide path control without trim upsets. Unlike conventional sailplanes the pilot sits within the allowable cg range.

HOW

The SOLITAIRE uses the proven materials and methods pioneered by Burt Rutan and used in the VariEze and Long-EZ, two of the most successful aircraft ever designed for the homebuilder. The wings are special uni-directional fiberglass cloth and epoxy resin. They are built using the moldless composite technique developed in the VariEze and consist of prefabricated 'S' glass spars and a solid foam wing core. The fuselage comes as two prefabricated halves. The bulkheads are available prefab and the wooden fixtures and templates will be available premanufactured. The canopy comes installed in the frame and the turtle deck is available prefabricated. All of the metal parts and complete landing gear components are available premachined. The premolded parts are of aerospace quality. Construction consists of prepreg skins with a honeycomb core and an adhesive film to bond them together. These are then vacuum bagged and cured in an oven. In short, this aircraft will have more prefabricated parts than any previous design from Rutan Aircraft Factory. Of the available prefabricated parts, the builder can buy all or as few parts as he wishes. We estimate that an average builder, purchasing all the available parts could build the aircraft in 400 hours at a cost of between $7000 and $9000. When the quality of parts and the ease of building is considered the value of the SOLITAIRE becomes apparent.

SUPPORT

Rutan Aircraft Factory support has been a key factor in the history of success with homebuilt aircraft. When you buy plans, you become one of a family of builders. Rutan Aircraft prides itself on its builder support program. We will answer questions either by phone or in writing. Builders are also welcome to bring parts to Mojave for inspections and advice. The quarterly newsletter is mandatory when you are building, as it provides continuing builder hints, ideas and plan updates.

ALL RAW MATERIALS.

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow, Box 424,
Fullerton, CA 92632
(619) 870-7551
Catalog $4

Near St. Louis.
WICKS AIRCRAFT
410 Pine Street,
Highland, IL 62249
(618) 654-7447
Catalog $3

ALL PREFAB MACHINE PARTS.

KEN BROCK MANUFACTURING
11852 Western Ave., Stanton, CA 90680
(714) 898-4366
Catalog $3

PREFAB FUSELAGE, CANOPY, TURTLE DECK, WING SPARS, SEAT PAN.
TASK RESEARCH
848 East Santa Maria, Santa Paula, CA 93060
(805) 525-4545

SPECIFICATIONS
SOLITAIRE - RAF Model 77-6

Empty Weight ..... 380 lbs.
Gross Weight ..... 620 lbs.
Total Wing Area ..... 102.44 square ft.
Span ..... 41.75 ft.
Wing Loading ..... 6.05 lbs./square ft
Engine ..... KFM 107E
BHP ..... 23 at 6000 RPM

Fuel ..... 5 gal. premixed @ 40:1
L/D ..... 32/1 at 50 knots
Min. Sink ..... 150 ft./mn @ 40 knots (approx.)
Descent Control ..... Spoilflaps usable to Vne
Min. Flying Speed ..... 32 knots
Vne ..... 115 knots
CG ..... unaffected by pilot weight

SOLITAIRE DOCUMENTATION
Canard Pusher Newsletter published quarterly.
One year's subscription $6.75

Section I - Manufacturing Manual $225.00
This is the complete education and construction manual for building the entire SOLITAIRE except for the engine installation. This manual consists of a spiral book 11" x 17" together with a set of 23" x 33" drawings, which include all necessary full-size templates, jigs and cross sections.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.1ft
Area	94.8 sq. ft.
Empty Basic	750 lb.
Empty Equipped	800 lb.
Solo Weight	1000 lb
Gross Weight	1425 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	600/950 ft
Climb (solo/gross)	1750/1250 fpm
Cruise 75% 8000 ft	186 mph
Cruise 40% 12000 ft	146 mph
Top Speed - Sea Level	193 mph
Max range * 75% (solo/2 place)	1380/1150 mi
Max range * 40% (solo/2 place)	2070/1690 mi
Ceiling (solo/gross)	27000/22000 ft

Landing dist. (solo/gross) 450/680 ft.
*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 full size drawings. It includes many photos, over 800 drawings and 65,000 words. The builder is led step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components. A video tape is available covering all aspects of building the moldless fiberglass/foam sandwich construction. The tape covers the latest methods used to obtain the optimum weight, strongest fiberglass lay ups. This presentation will help both the first-time and experienced builder and attain quality aircraft workmanship.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction for the complete engine installation, including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

A video tape is also available which covers the weight and balance procedures, taxi tests and first flight.

LANDING BRAKE - Complete full size drawings for the landing brake device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail to U.S. & Canada	Overseas Airmail - U.S Funds
Rutan Aircraft Information Package - complete data and photos of all Rutan designs.	$ 8.00	$ 9.00
"Canard Pusher" newsletter Published quarterly. One year subscription. Approx. 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIL Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50

Long-EZ Landing Brake	10.00	11.00

6% Sales Tax, if Calif. order.

Newsletter not taxable.

The following are RAF-authorized distributors of Long-EZ materials and components. Contact the distributors at the addresses below for their and description of items.

ALL RAW MATERIALS AND PREFAB FIBERGLASS PARTS

Near Los Angeles	Near St. Louis
AIRCRAFT SPRUCE	WICKS AIRCRAFT
201 W. Truslow, Box 424	401 Pine Street
Fullerton, CA 92632	Highland, IL 62249
(714) 870-7551	(618) 654-7447
Catalog $4	Catalog $3

Prefab machine parts such as, control system parts and welded parts, fuel caps, engine mount, rudder pedals and exhaust systems.
KEN BROCK MANUFACTURING
11852 Western Avenue
Stanton, CA 90680
(714) 898-4366
Catalog $3

Main and nose gear, fuel strakes, fuselage bulkheads.
TASK RESEARCH INC.
848 East Santa Maria
Santa Paula, CA 93060
(805) 525-4545

Canopies are available from RUTAN AIRCRAFT.

RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

Solitaire in her final configuration with the KFM engine.
Top - engine folded away and doors closed.
Bottom - Engine up and running.

PHOTOS OMITTED

Canard Pushers from 1 to 82

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THE CANARD PUSHER NO 37 JULY 83

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 37. If you are building from 2nd Edition plans you must have newsletters 18 through 37. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 37. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 37. If you are building a Long-EZ you must have newsletters from 24 through 37. If you are building a Solitaire, you must have newsletter starting with 38.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

SUBSCRIPTIONS
Many of our subscribers have asked us if a renewal can be made for a two or three year period at one time. This is ok with RAF. Please remember to state your subscription number when renewing. A lot of our readers send in the label from their last CP along with their renewal. This really helps us process your renewal quickly and more accurately.

OSHKOSH
It is that time again when RAF trucks and flys across the country to meet old and new friends once again. Any guesses on how many EZs we

will have this year? Here at RAF everyone takes a "no money" bet on how many of each Rutan type there will be!! RAF will have the Long-EZ and the Solitaire on display.

Burt will be giving talks on the following dates:

Solitaire	July 31	12:00 p.m.
Design College	August 1	10:30 p.m.
Long-EZ	August 1	1:30 p.m.

The Design College talk will be about "High Angle Of Attack Flight Test".

The International VariEze Hospitality Club banquet is being held on July 31 at Butch's Anchor Inn. You need to be a member of the club to attend. Tickets are available from Don Shupe, 2531 College Lane, La Verne, CA 91750 at $11.00 each.

We will have the usual daily "bull sessions" for the EZ pilots. A note will be posted in the booth for times.

Please remember that there will not be anyone to answer builder calls at RAF during Oshkosh. The office will be open but both Michaels will be gone.

SOLITAIRE
The plans were taken to the printer this week. As always, writing the plans for an airplane is a long, tough haul.

The plans consist of 25 pages of 23 x 33 full size drawings and an 11 x 17 book with 81 pages. The plans will be available for sale at Oshkosh. We will start writing the engine installation and the Owners Manual after Oshkosh and anticipate that these will be available around the first of the year.

Peter Garrison of Flying magazine and Peter Lert of Air Progress have both flown Solitaire recently. Look for magazine articles. There will be an article in the Sport Aviation August issue.

HAPPY BIRTHDAY BURT!!
The RAF gang decided that is was time again to have an EZ flyin at Mojave. What better way to do that, than to give Burt a party!! 30 VariEzes, 12 Long-EZs and 1 Viggen flew in to Mojave (despite the 20-40 knot winds) to help RAF wish Burt a Happy Birthday.

A chicken and fresh fruit lunch was enjoyed by about 140 people. We had one VariEze fly in from Louisville, MS. The builder/pilot Bud Foster could not make it but he wanted his EZ to enjoy the day. So his friend Bob Langley flew it in for him!! Everyone had a great time meeting new friends and saying hello to old ones. Lots and lots of hangar stories. Mule Ferguson from Boone, North Carolina could not make it, but sent a video tape to wish Burt a happy day. We all enjoyed Mules singing and at last visiting Boone. Mule included a few surprises on the tape which Sally says she needs to talk to him about!!

With 43 EZ type aircraft on Mojave Airport, it made the largest gathering of EZs other than Oshkosh. Burt was wandering around the

airplanes with a smile on his face when he sort of looked around and said "Everyone looks so happy!" EZ people are!!

We thanked everyone that came by to help make the day such a success. The day was very special and one to be remembered. EZ folks are just great!!

Invitations were sent to all the folks we have on our EZ fly list. We received quite a few back because of incorrect address, moved, not know etc. Please let us know if you do change your address as we occasionally do need to notify you of changes or send you invites to fun parties. Please keep us up to date. Thanks.

Local Flyins
N26MS representing RAF went to the Watsonville, Merced and Porterville flyins so far this year. Watsonville as usual was great, over 30 EZs were parked in the display area. The weather on Saturday was crummy but cleared up on Sunday. The strawberries (the size of apples!) and cream, the artichoke hearts and the extremely well organized parking area, the security for your airplane, the way you are treated as a pilot flying in - outstanding. Oshkosh could certainly learn a thing or

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two from the folks at Watsonville. Merced was very nice, the weather excellent. The antique aircraft on display are without peer. Again, quite a few Ezs were there. After the airshow, a group of us flew up to Mariposa and had an excellent barbecue at Frank and Marge Tifft's home. Their Long-EZ is gorgeous! The Porterville flyin was neat. Not so many EZs, we only counted 6, but a real country flyin, laid back atmosphere, lots of flybys with a great dance band with dancing on the ramp after sun down into the "wee" hours of the morning!

CAFE 400 - 1983 - EZs Win Again This Year!!
This year RAF entered the prototype VariEze N4EZ and the prototype Long-EZ N79RA as well as the Defiant. The course was much more representative of a practical cross country and included a fair amount of climbing with some reasonably high altitude flying. The procedures for weighing the aircraft both before and after the race as well as the quality of the electronic scales were of the highest order. Brien Seeley and his CAFE 400 crew are to be complimented on an excellently organized race.

The weather on race day could not have been better. Sally flew N79RA. This was her first try at a competitive event such as this and she decided to try for maximum MPG (a separate award) rather than a high CAFE score since we knew the Long-EZ could not beat the CAFE number for a VariEze (the VariEze is smaller and faster). For this reason she flew very slowly. Her race time showed a speed of 107 mph, very close to her aim speed. Her credited mpg was disappointing at 36.93 mpg, but it still gave her the third highest mpg in the race. Her mpg was a bit of a curiosity to us, since her credited fuel use was more than the total fuel carried in the tank used. Our measurements showed she should have attained 48 mpg and placed 5th in the CAFE number. Burt flew Defiant a little slower this year also shooting for higher mpg.

He placed 2nd in his class, 3 or more seats experimental and third in the twin engine class.

Mike flew N4EZ and this turned out to be an opportunity for a head to head contest with the Quickie Aircraft Corp. Q2 .The Q2 now has an 0-200 Continental as does N4EZ. The factory Q2 was very carefully prepared, including a dyno tested engine with a special AR (reverse cone) exhaust system, race optimized propeller and a Texas Instrument Loran C for accurate navigation. Also much test flying was done prior to the race by the Q2, presumably to determine best speed to fly.

Conversely, N4EZ was wheeled out of the hangar for the first time in over 6 months the day before the race. We blew the dust out of the cockpit with a shop air hose, fired her up and flew for 15 minutes to warm up the oil. Landed and changed the oil and checked the bottom spark plugs. That was the full extent of our pre-race preparation. We did not even wash or wax the "old girl".

The results speak for themselves. N4EZ's speed was slower by 1.5 mph but the mpg was higher as a result of which, N4EZ easily beat the Quickie Q2 in the CAFE score (2098489 vs 2040888). This verified to us what we have known all along, that a VariEze (even a tired, dirty one) is more efficient than a Q2 (even a super clean, specially prepared one). The other Q2 in the race, powered by a Revmaster and turning a variable pitch prop, was soundly beaten by all 4 VariEzes in the race. N4EZ beat this Q2 not only in mpg, but also by almost 20 mph in speed.

The crowning glory of the course was the excellent performance of Gary Hertzler's VariEze (Continental A-80, 80 hp) which turned in 44.65 mpg at a speed of 145.4 mph. He carried 400 lbs of payload, so this gave him a CAFE score of 2596258! This placed Gary first in the two place category and 5th overall. The CAFE score was over 27% higher than the best Q2! He was only beaten by aircraft carrying four or six passengers. All four VariEzes competing got higher mpg scores than either one of the Q2s. This race, as well as last years, in which a Long-EZ won the experimental category, really makes a person wonder what ever happened to "the world's most efficient airplane"?

Incidentally, we ran Gary's VariEze performance numbers through using the original CAFE 250 rules and formula. He would have beaten the Q2 that year as well, 125159 for the Q2 and 129784 for the VariEze. Unfortunately he did not enter his VariEze in the first CAFE race, the CAFE 250, 1981. The results of the 1983 CAFE 400, in the two place, experimental category are as follows:

	Aircraft	Pilot	Payload	Speed (MPH)	MPG	CAFE Score
1	VariEze	Hertzler	400 lbs	145.4	44.63	2596528
2	Dragonfly	Rutan	400 lbs	128.3	45.08	2312985
3	Glasair	Hamilton	400 lbs	178.6	29.82	2130225
4	VariEze	Melvill	400 lbs	154.2	34.02	2098489
5	Q2	Sheehan	400 lbs	155.7	32.76	2040886
6	VariEze	Sorensen	400 lbs	148.6	33.56	1994933
7	VariEze	Wallrath	375*lbs	146.4	35.38	1941886
8	Q2	Schilling	400 lbs	135.0	33.52	1809342
9	Glasair	Srour	386 lbs	172.3	24.68	1642267

10	RV-4	Grunsven	400 lbs	168.7	23.90	1612300
11	Long-EZ	Melvill	400 lbs	106.9	36.93	1579890
12	MustangII	Devereux	400 lbs	165.8	23.73	1573868
13	Glasair	Powell	400 lbs	156.3	23.78	1486520
14	Tailwind	Weaver	400 lbs	139.2	21.56	1200235

*Note: If Wallrath had carried his maximum allowable payload, of 400 lbs., he would have placed 5th.

OVERSEAS
Australian Race - A fuel Efficiency Race was held in Mangalore, Australia. The race was 250 miles with rules similar to the LBF at Oshkosh. The winner was Bob MacGilivray in a VariEze. The results were 33.7 miles/gal (imperial gallons) at a speed of 145.3 knots. Congratulations Bob!!

South Africa - Annual EAA Flyin. George Allison of South Africa called to let us know that he "cleaned up" with his Long-EZ at the flyin. He came away with Grand Champion, 1st place Best Composite, 1st place Concorse de Elegance Good for you George!!

England - Don Foreman recently won Grand Champion with his Long-EZ at the Cranfield Airshow, (the English version of Oshkosh). He is having a ball with his Long-EZ and has promised some performance figures and photos soon. Don has the first Long-EZ to fly in England. He has a Continental 0-240, 130 hp engine and tells us "it flies great".

CLUBS
Dayton 'Ducks' (Dayton United Canard Klub) held is first organizational meeting and workshop. 18 members were present, most of whom are building VariEzes and Long-EZs. The 'Ducks' would like to extend an invitation to all EZ types to contact them for meeting dates and times to share knowledge, special skills and above all, have a lot of fun the 'EZ' way.
Contact: Mike Zimmerman, 7313 Dabel Court,Dayton, OH 45499. (513)434-6800 or (513)435-0882.

Late Flash

Jackpot, Nevada Flyin
The IVHC flyin at Jackpot, NV was a great success. Shirl Dickey organized it and the flyin was super according to Debbie Iwatate. Debbie flew her Long-EZ in from Washington state. She tells us two Long-EZs and 17 VariEzes flew in. The consensus was to make this an annual flyin.

The 'Real' George Scott reports over 80 hours on his Long-EZ and he is very happy with it. George is willing

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to help local builders with a back seat check out before they fly their Longs. Contact George at 14102 Susan Crest, San Antonio, TX 78232.

CAUTION - SWAGING NICOPRESS SLEEVES

A properly installed nicopress sleeve will hold beyond the point where the cable breaks. Be certain that you are swaging your cables correctly. The "cheap" nicopress swaging tools that commonly sell for around $15.00 and work by tightening two bolts, are fine. That is what we use here at RAF. **SKETCH OMITTED**

It is important to use the tool correctly. The sleeve should be oriented vertically per the sketch with the cables as shown. Tighten both bolts equally, about a half turn at a time until the two steel faces of the swaging tool are firmly together.

CAUTION
We have had this one in the CP before but is it important enough to warrant a rerun. The leading edges of the lower surface of your ailerons must be rounded per plans per page 19-14. If you have a sharp corner here your aileron could develop a heavy vibration at full control deflection from 90 to 120 knots. Sand this corner round to follow the shape of the steel mass balance weight. **SKETCH OMITTED**

CAUTION: Testing experimental props may be a hazardous thing to do. A Long-EZ builder/flyer was testing a pretty fancy, thin bladed, flexible prop when both blades failed just outboard of the hub. Fortunately this particular prop had a ply of Kevlar wrapped over the prop full span. Only the Kevlar stopped the blades from departing the airplane, the pilot made a safe landing.

BUILDER HINTS
Mike Rhodes reports having difficulty bonding the aileron hinges to the aileron and keeping everything aligned at the same time. He came up with a neat idea to use a piece of scrap foam rubber between the wing and the hinge which due to its springiness will hold the hinge tight against the aileron at A2 and A5 until the Bondo sets. (see sketch). **SKETCH OMITTED**

FUEL TANK AND SUMP BLISTER LEAKS
There is nothing more discouraging that getting your airplane ready all the way through to paint and then to find fuel tank leaks. Lately a few builders have reported leaks found in the sump blisters. You must paint a generous coat of Safe-T-Poxy on the inside of your fuel strakes, on the side of the fuselage, on the forward face of the centersection spar and the inside face of the baggage wall and outboard rib. Do not neglect to do this. Its a good idea to squeegee the epoxy onto these surfaces to ensure that you force the epoxy into any tiny pin holes that may exist. Allow the epoxy on the inside of the top of the strake to tack up or even cure before installing. Paint a real generous coat of Safe-T-Poxy inside the sump blister prior to installation. Most important, leak check your tanks before you do any finishing work. Leaks should be repaired per the instructions in previous CPs.

Long-EZ builder, T. Dinneen has the following suggestion for obtaining an engine for your Long-EZ. He paid $7,500 for a 1978 Tomahawk in good flying condition. Not only did he get an airplane to fly and stay current in, but he also got:
1) A Lycoming 0-235 L2C engine complete, including a mechanical fuel pump with 920 hours total time
2) A full gyro panel and instruments

3) 500 x 5 wheels, tires, brakes, axles and master cylinders
4) 720 channel com, Nav and VOR head
5) Transponder
6) Nav lights/strobe anticollision light system
7) ELT and seat belts
8) Circuit breakers, engine instruments and battery
9) Fuel plumbing, fuel valve, electric fuel pump etc.

In addition, he figures he can sell the airframe for about $1,000.00 after he has 'gutted' it. This means he has laid out $6,500.00 for the lot. On top of that you can bank finance the whole deal. Check Trade-a-Plane for "deals" on Tomahawks!

LORAN C IN A LONG-EZ

This is becoming more and more popular. We at RAF have no experience with the Loran C at all. Several builders have installed them and a few are flying. None that we know of work perfectly.

Loran C is very sensitive to noise. Electrical, generators, alternators, voltage regulators, Compucruise all put out noise. This noise is not noticed normally by your VHF equipment (nav and comm) but is is noticed by VLF like the Loran C. This can disrupt your reception and drop out the signal giving you erratic performance. Almost all of the problems we experience with Loran C with our EZs, do not occur with aluminum airplanes due to their inherent shielding and large ground plane. If you intend installing a Loran C, do everything to can to shield your electrical system. Every wire should be shielded. In addition, it is an excellent idea to run your wiring inside a metal conduit. Tom Williams, a Long-EZ builder/flyer suggests using 1/2" diameter copper refrigeration tubing. Run this from the battery to the aft face of the firewall, one piece down each side of the fuselage on the floor against the sides. All wiring except antenna coax and the positive wire to the starter, should go inside these conduits. Sweat solder a copper clamp to each end of these copper conduits (make a clamp from a 2 1/2" length of the same copper tube. Split it, flatten it out and wrap it around the conduit as shown). **SKETCH OMITTED**

Bolt a short length of #2 wire (for 12 volt systems, #4 for 24 volt systems) from the clamp on the forward end of one conduit to the negative terminal of your battery and the aft end should be securely grounded to the firewall, which in turn should have a braided ground strap to the engine. Thus you are killing two birds with one stone. The copper conduit serves as a ground wire from your engine to the battery, as well as an excellent shield for the wiring.

Rodie Rodewald, a Long-EZ builder from Hawaii has been working with Loran C in his Long for over a year. He finally cleaned up his electrical noise by installing one of B & C Specialities 35 amp alternators and their latest and quietist voltage regulator. He tells us it is an absolutely first class piece of equipment. Rodie has also tried many different types of antennas with varying success. Of course in Hawaii, he has the worst possible situation, since he is using one station on Hawaii and one on Guam! We figure if it works for him, it should work great for anyone here on the 'Big Island'! Rodie's antenna consists of RG-58U coax cable from the Loran C set to the preamp in the winglet. He buried his antenna preamp in the lower winglet. From the preamp he ran .025 stainless safety wire up past the

rudder, keeping it as far as practical from rudder hinges, bolts, nutplates and wing tip lights/strobes etc. Once in the upper winglet, he zig zagged fore and aft going up until he used 108" of wire. This antenna has worked the best so far of any he has tried, including the use of the rudder cable in the wing.

Anyone with any more information on how to make a Loran C work well in a composite airplane, please drop us a line. This is not a real straight forward problem guys, if you think you can just bolt a whip antenna on the belly and have a flawless, reliable Loran C, you are in for a surprise. This will work on a fiberglass boat, but remember, a boat is sitting on the largest ground plane possible, the ocean!

We will continue to gather data on Loran C, as it really does seem to be the way to go. It would really compliment the excellent cross country capability of the Long-EZ making it even more of a utility airplane.

VariEze/Long-EZ Cowlings.
The aft stiffener rib that runs across the inside aft edge of the cowlings, both top and bottom should be taped in with a 1 1/2" wide BID tape all around. These ribs are floxed in but may pop loose due to vibration.

The following letter is from a builder who had an epoxy reaction.

"Dear RAF,
I am writing this letter to express my appreciation to you and Applied Plastics for "saving" my composite homebuilt Long-EZ project! About two months ago, I called you to get your advise re: how to prevent any further or worsening of the dermatological (rash, burning, itching hands and arms) reaction I had experienced after a six hour session with Safe-T-Poxy and acetone.

I followed you advice and changed my shop routine as follows:
a) Started using Norton Butyl rubber gloves exclusively..
b) Stopped using acetone (I now discard brushes and just wipe down squeegees).
Since I was already using a charcoal filter respirator, no change required there. I did improve the ventilation in my shop.

I have had some lengthy lay ups since with no sign of a problem. While they are relatively expensive, I think you should strongly recommend the use of the Butyl gloves.

Thank you again for your professional, prompt and sincere response to a problem, which very easily could have "shot down" a project which is very important to me.

Sincerely, Gary Holmes."

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

LPC #116 Owners Manual, Page 30, Change aft limit from 104 to 103.

Section IIL - NOTE: The engine installation plans update and supercede information in Section I. Do not do any work aft of the firewall without having Section IIL in your hands. Section IIL also has lots of information on engines, which may help you to make your selection.

NOTE: NO plans changes for VariEze this time.

SHOPPING

Please note that prices for the Com. Antenna from Radio Systems Technology is as follows:

$25.00 for the assembled antenna
$15.00 for the unassembled antenna
plus $3.25 for shipping and handling

Task Research has a price increase on the main and nose gears. The main gear is now $344.00 and the nose gear $61.70. (805)525-4545.

Propellers
We recently tested a Great American prop on our 0-235-L2C (118 hp) powered Long-EZ and found it to be an excellent prop. Performance was virtually identical to the best Ted's prop we had previously tested. Take off distance was slightly shorter, climb slightly better and top speed was only down about 1 mph.
Contact: Great American Props.
555 Westmont Drive
San Luis Obispo, CA 93401
(805)481-4450

Sensenich Corporation is now manufacturing VariEze props. They are excellent. The only source for the prop is John Benjamin, 973 Nissley Road, Lancaster, PA 17601, (717)898-8586

John usually carries two different props in stock and they are available for immediate shipment.
VariEze Prop W58LKL-69 (climb prop)
VariEze Prop W58LKL-71 (cruise)

These props have 13 laminations of selected birch in them and also have a rain resistant epoxy leading edge. Call or write to John Benjamin for more information. John is a VariEze builder/pilot and is 2/3 of the way through building a Long-EZ.

The alternator and special regulator mentioned in the Loran C article is available from:
B and C Specialty Products
518 Sunnyside Court
Newton, KS 67114 (316)283-8662

FOR SALE

Brand new - direct form the factory 0-235-L2C - $8,695.00
Contact: Norm Bender
(910)794-0032

Lycoming Engines - call for pricing information
Contact: Aircraft Spruce and Specialty
(714)870-7551

0-320 hp Lycoming 160 hp - bent flange, dual mags and starter
Contact: Nick (714)824-1020

0-320-E2D 150 hp, 761 since major, all accessories and mounting plate for fuel pump. $5,000.00 or best offer.
Contact: Larry (408)296-5218

0-235-L2C Lycoming, 200 hours since major, all accessories. Crankshaft bent (flange) .008, will need to be tore down and straightened. $3,500.00

0-235-L2C - 1180 total time since new. All accessories, $3,500.00

0-235-C1 Lycoming - needs to be rebuilt. $2,000.00
Contact: Al Head, (213)426-8309 for all three of the above.

Original VariEze main and nose gear
Contact: Ed Hanley
4351 Firerock Circle
Memphis, TN 38118 (901)794-5685

Solar Panels designed by Solair Development Co., available from Aircraft Spruce and Specialty. $188.00

ACCIDENTS
Unfortunately this newsletter we have several bad accidents to report. As always, we publish this information in the hope that it may save someone else in the future. The really distressing part about these accidents is that it appears that almost all of them have one thing in common. Low level, close proximity to the ground, high speed flying. This fact has nothing to do with the airplane. This is purely pilot. We all should be aware of this and each of us should realize that the risk of flying fast and close to obstacles is very high risk and if you continue to fly this way, it is only a matter of time before you too become a statistic.

A northeastern California VariEze pilot and passenger were fatally injured when their VariEze crashed into trees on a ridge at 7,000 feet. The aircraft was traveling upslope towards the ridge when it struck the tree tops. The engine was developing power at the time of impact. No control system failures or airframe failures were found or suspected. The aircraft had been reported to be flying at extremely low altitudes earlier.

A Long-EZ crashed in central California. Both occupants were fatally injured. The aircraft was observed flying low down a river. As it flew over a bridge it struck unmarked power lines. The aircraft continued on for about a half mile where it crashed into trees. No problems were found or suspected with the aircraft.

A Long-EZ flying over the ocean in south western Florida crashed into the water. Both occupants were fatally injured. This aircraft was observed by several eye witnesses to be flying at cruise speed low across the water, estimates of from one wingspan to 100 feet above the water. It hit the water and was heavily damaged. The pilot was found to have a brain tumor and had been experiencing severe headaches. It is not known however if there is any connection.

A VariEze in France, took off from the Nice, France airport with two people aboard. The airplane climbed straight ahead to about 150 AGL, turned left, started losing altitude while continuing the left turn until it impacted the ground at a point at about midfield on a heading 180 degrees opposite the take off heading. We have not had much information on this, but there is reason to believe that the canopy may have been unlatched.

Shortly before this newsletter went to press, we began investigation a fatal accident in which a Long-EZ apparently struck the ground in a flat attitude, possibly from a flat spin or deep stall. Of course, the results of all testing shows that a Long-EZ is not capable of a flat

spin or deep stall, when flown within the allowed limits. Preliminary information shows that the cg may have been behind the aft limit. Even though this aircraft was highly modified, we are concerned that it is possible that others operating near the aft limit and with contour tolerances that degrade flying qualities from the intended and tested configuration, may also be susceptible to spins. At least until this accident is totally investigated and understood we are recommending the Long-EZ aft cg limit be moved forward one inch. Also be sure you follow to the word all information on Pages 44 and 45 of the Owners Manual.

VARIVIGGEN NEWS
We have received several letters from Viggen builders that were circulated to all the builders through the Viggen Club list. This is encouraging and we are sure this is helping each of you to maintain the necessary drive and enthusiasm to complete a project of this magnitude.

Arthur Schwartz called and tells us he has over 230 hours now on his bird. He is hoping to join up with Peter Lawrence and fly the two Viggens to Oshkosh. Unfortunately we will not be taking N27MS to Oshkosh this year. This will be the first year she has missed since 1978.

One thing has struck me recently about almost all Viggen builders - most are gadget/gismo freaks, including me. Knowing what I do now, what with over 600 hours each on my Viggen and my Long-EZ, I would build a Viggen as light and simple as it was possible to do. Contrary to popular belief, the Viggen is not an airplane to load up with avionics and instruments. Do not put anything in there that is not absolutely necessary for flight. Inspite of its 180 hp, our Viggen, at an empty weight of 1252 lbs. is really hard pressed to make it out of many high density altitude airports. We have been in and out of a few, Denver, Laramie, Rock Springs, Rawlins, Taos, even Albuquerque, but each time I have carefully calculated density and used every bit of knowledge and skill I had to get out. At full gross weight our Viggen is a marginal high density airplane. Burt's prototype N27VV, was much lighter at 1070 lbs and was quite sprightly compared to mine, even though he had only 150 hp. Keep them light. Believe me, I would give anything to be able to take 200 lbs out of my Viggen.
See you at Oshkosh. Any thoughts on how many Viggens will fly in? We know of a total of 14 Viggens that have flown since the plans were released in 1974. I wonder how many will be at the show?

A multitude of Viggen parts.
Contact:
Richard Stewart
RT 2, Box 251-D
Lovettsville, VA 22080

Several Viggen parts and plywood.
Contact:
Delbert Dester,
109 Holland Grove Lane,
Washington, IL 61571

SOLITAIRE -
A
Self-Launching
Sailplane

The Problem
For a long time soaring has been an exclusive sport requiring a special license and training. Soaring in a glider of enough performance to allow the average pilot to feel the true thrill of 'engineless' flight has been expensive enough to severely limit the number of people who enter the sport. At the same time, interest in ultra-light and light sport aircraft has reached an all time high.

The Challenge
The Soaring Society of America recognized the problem. Other segments of homebuilt aircraft were experiencing great interest and activity on the part of designers and the general public. The sailplane market was not getting it's share of the attention. To correct this, the SSA issued a challenge in the form of a contest. Develop a self launching sailplane capable of take off and climb to altitude without the use of a tow plane. The new design could be flown without the special license required of a sailplane pilot, just a private pilot's license. The aircraft must be easy to fly, as well as easy and quick to build. Strict rules were set up and an actual structural test of the finished aircraft was required. The Solitaire was designed around these goals and achieved these and more.

The Winner
At the flyoff held at Tehachapi, California, on September 6, 1982, the judges studied the entries and flew the SOLITAIRE and unanimously declared it the winner.

WHAT
The SOLITAIRE is a single-place self launching sailplane, fitted with an engine package that folds into the nose of the aircraft after it pulls the SOLITAIRE to soaring altitude. With the engine folded, it has a L/D of 32 to one giving it true soaring capability. The engine can be deployed and restarted inflight using it's electric starter. The canard concept results in high resistance to inadvertent stalls and spins. It's 'spoilflap' descent control system has been acclaimed as "excellent" by all evaluators, providing crisp, variable glide path control without trim upsets. Unlike conventional sailplanes, the pilot sits within the allowable cg range.

HOW
The SOLITAIRE uses the proven materials and methods pioneered by Burt Rutan and used in the VariEze and Long-EZ, two of the most successful aircraft ever designed for the homebuilder. The wings are special uni-directional fiberglass cloth and epoxy resin. They are built using the moldless composite technique developed in the VariEze, and consist of prefabricated 'S' glass spars and a solid foam wing core. The fuselage comes as two prefabricated halves. The bulkheads are available prefab and the wooden fixtures and templates will be available premanufactured. The canopy comes installed in the frame and the turtledeck is available prefabricated. All of the metal parts and complete landing gear components are available premachined. The

premolded parts are of aerospace quality. Construction consists of prepreg fiberglass skins with a honeycomb core and an adhesive film to bond them together. These parts are then vacuum bagged and cured in an oven. In short, this aircraft will have more prefabricated parts than any previous design from Rutan Aircraft Factory. Of the available prefabricated parts, the builder can buy all, or as few parts as he wishes. We estimate that an average builder, purchasing all the available parts, could build the aircraft in 400 hours at a cost of between $7000 and $9000. When the quality of the parts and ease of building is considered the value of the SOLITAIRE becomes apparent.

Support
Rutan Aircraft Factory support has been a key factor in the history of success with homebuilt aircraft. When you buy plans, you become one of a family of builders. Rutan Aircraft prides itself on it's builder support program. We will answer questions either by phone or in writing. Builders are also welcome to bring parts to Mojave for inspections and advice. The quarterly newsletter is mandatory when you are building, as it provides continuing builder hints, ideas and plans updates.

SPECIFICATIONS
SOLITAIRE - RAF Model 77-6

Empty Weight	380 lbs.
Gross Weight	620 lbs.
Total Wing Area	102.44 square ft
Span	41.75 ft.
Wing Loading	6.05 lbs/square ft
Engine	KFM 107E
BHP	23 at 6000 RPM
Fuel	5 gal. premixed @ 40:1
L/D	32/1 at 50 knots
Min. Sink	150 ft/mn @ 40 knots (approx)
Descent Control	Spoilflaps usable to Vne
Min. Flying Speed	32 knots
Vne	115 knots.
CG.	unaffected by pilot weight.

SOLITAIRE DOCUMENTATION

Section I - Manufacturing Manual - - - $225.00
This is the complete education and construction manual for building the entire SOLITAIRE except for the engine installation. This manual consists of a spiral bound book 11" x 17" together with a set 23" x 33" drawings, which include all necessary full size templates, jigs and cross sections.

Section IIKFM - Engine Installation - - - $15.00
Instructions for the installation of the KFM engine.

SOLITAIRE Owner's Manual - - - - $5.00
This is the required operations handbook and checklists for flying the SOLITAIRE.

ALL RAW MATERIALS.

Near Los Angeles. Near St. Louis.

AIRCRAFT SPRUCE
201 W. Truslow, Box 424,
Fullerton, CA 92632
(619) 870-7551
Catalog $4

WICKS AIRCRAFT
410 Pine Street,
Highland, IL 62249
(618) 654-7447
Catalog $3

ALL PREFAB MACHINE PARTS.
KEN BROCK MANUFACTURING
11852 Western Ave.
Stanton, CA 90680
(714) 898-4366
Catalog $3

PREFAB FUSELAGE, CANOPY, TURTLE DECK, WING SPARS, SEAT PAN.
TASK RESEARCH,
848 East Santa Maria,
Santa Paula, CA 93060
(805) 525-4545

LONG-EZ
FAST
EFFICIENT
HIGH UTILITY
LONG RANGE

THE AIRPLANE
The Long-EZ is a small, high-performance, high utility homebuilt sportplane. While recommended mainly for day-VFR operation, competent pilots can also equip it for night and IFR flying. The recommended power plant is any model of the 0-235 Lycoming. Note that a mechanical fuel pump is required. It has an alternator-powered electrical system and can be equipped with electric engine starter. Its cockpit layout is designed to complement pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wingstrakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 PV core foam (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core, reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal and wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

TRAVELING MACHINE

At last, an airplane that is specifically developed for efficient, high speed, long range traveling with room for two adults and plenty of baggage. Fuel allowance with two adults is 41 gallons. Single place, you can carry 52 gallons. If you're in a hurry, you can cruise at 75% power at 8000 feet at 189 mph (164 kts) burning 6.6 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles) in 5.1 hours with one hour fuel reserve. If you're not in a hurry, you can cruise "economy" at 12,000 feet at 146 mph (127 kts), burning only 3.6 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 9.8 hours with a 1.5 hour fuel reserve. Single place, using the entire 52 gallon fuel capacity, stretches the maximum range and endurance to over 2400 miles and 23 hours!!

UNUSUAL EFFICIENCY
The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a world's distance record, and landing with enough fuel to surpass 5000 miles. At that, its capability was not taxed - its initial climb rate was over 600 ft/mn! At light weight, it climbed to 27,000 ft. in still air - an altitude unheard of, for a fixed-pitch, non-turbocharged airplane. Our Long-EZ is so efficient, the engine can be shut down while at 5 foot altitude over the numbers at only 120 knots, then it can pull up, fly a 360 degree pattern and land on the same runway - completely without power! Its power-off glide angle is only 3.7 degrees - thus a belly mounted drag device (landing brake) is used for landings.

SUPERB FLYING QUALITIES
Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and docile stall characteristics. It resists stall or spin even when maneuvered sharply to full aft stick. Flight tests show the prototype to be free from stall departures and spins for all type of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed. Trim changes due to power, gear retraction or landing brake are all very small. Its wide cg range allows a large range of pilots or passengers weighing up to 250 lbs.

The Long-EZ's approach and landing speed are 75 mph (65 kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.

PHOTOS OMITTED

THE HOMEBUILDER SUPPORT
The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher" published since 1974, updates plans, provides building hints, etc. Complete Owners Manual provides all necessary information for

initial testing and for normal emergency operations. You may call, write or bring parts in for inspection at any time.

THE TEST PROGRAM
The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR Part 23 requirements, static load test and landing gear drop test exceeding Part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing and many others.

COST AND BUILDING TIME
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, controls system materials, plumbing, tires, wheels and brakes cost about $3600. Any of these items can be purchased separately. We strongly recommend that you get the distributors' catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

Many other prefab parts ranging from main gear, nose gear, propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased from the listed distributors. All those prefab parts cost approximately $3000 - and using them, the competent builder can build a Long-EZ in as little as 1000 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above costs of the prefab items. Contact the distributors for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

Engine costs vary widely. Our prototype has an 0-235 Lycoming, that had 1400 hours when purchased, for $1,500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from $3000 to $6000. Engine accessories, such as instruments, prop extensions, etc. cost about $500 to $700.

In summary the total cost can run from $6000 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $14,000 for everything available purchased and a zero time engine. IFR avionics can add from $2,000 to $15,000 to those numbers, with many options available.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

43 EZ type aircraft flew in to Mojave for Burt's Birthday, July 18, 1983. What a sight!!

THE CANARD PUSHER NO 38 OCT 83

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 38. If you are building from 2nd Edition plans you must have newsletters 18 through 38. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 38. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 38. If you are building a Long-EZ you must have newsletters from 24 through 38. If you are building a Solitaire, you must have newsletter from 37 to current.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

NEWSLETTER SUBSCRIPTION - YOU DO NOT HAVE TO WORRY ABOUT A CP NUMBER ANYMORE!!!!!!
Well here we go again. The newsletter mailing list has out grown the program that was written for it a few years ago. Jeff Hiner, Burt's son has been very busy these last few months and has come up with a new program for us to use on the Apple. He promises me that we have bunches of space. It is so fast (takes 4 to 6 seconds to look up a name) that we can even look you up and check on your subscription when you call on the phone. You will be pleased to hear that you do not

have to bother with a subscription number, the program deals with everything alphabetically.

RAF ACTIVITY
Since Oshkosh, RAF has been to the Soaring Society of America's Homebuilders Workshop at the Tehachapi, California gliderport and also to the San Diego flyin held at Brown Field where Solitaire was awarded "Best Sailplane" and "Best New Design". Fred Keller brought his Defiant to Mojave after Oshkosh and a full flight envelope was done on the aircraft. Mike Melvill has been busy as one of the test pilots on Burt's new Starship project. Work continues on finishing up the Owners Manual and Engine installation for the Solitaire.

DEFIANT
Perhaps the biggest news of the week at Oshkosh was Burt's announcement, making the Defiant available to the homebuilders. Almost two years ago Burt had asked Fred Keller of Anchorage, Alaska if he would like to build a homebuilt prototype of Burt's own Defiant. Fred agreed. Fred and his wife, Sharon flew their absolutely beautiful Defiant from Anchorage to Oshkosh. It was without a doubt one of the most popular aircraft on the flight line. Fred's achievement of completing an airplane the size and complexity of the Defiant, in the time he did is incredible, especially when you stop and consider that he was not only building virtually every single part himself, he was also keeping accurate records, drawings and photographs of his progress, in order to be able to put together plans for the homebuilder. The Defiant plans will be marketed by RAF in exactly the same way as the Long-EZ and Solitaire plans. RAF will supply the plans and normal builder support. Any support requiring interpretation of the plans will be handled by Fred Keller, either by phone or by mail. We intend to have Defiant plans available by March of 1984. We are excited about this program and feel that this will fill a very real need for those homebuilders who require a four place and will also provide these builders with the safety of two engines without the inherent dangers associated with "normal" twins.

According to the FAA, a pilot will require a private pilots license to fly his or her own Defiant. A multi engine rating is not mandatory, although common sense would call for at least a center line thrust rating, which could be obtained in ones own Defiant.

STARSHIP I
Burt's latest design, a large business aircraft powered by two PT-6 turbo-prop engines and looking like a gigantic Long-EZ, recently has been making the headlines. This aircraft was designed by Burt for Beechcraft of Wichita, Kansas. The proof of concept prototype is an 85 percent scale demonstrator and was built next door at Burt's new company, Scaled Composites. Unlike most proof of concept aircraft, this one has the workmanship and surface contour etc. of a grand champion! Started in January 1983 and first flight (pilot - Dick Rutan) was in August 1983. It has been flown almost daily since then and has over 100 flight hours already. Beech made their dramatic announcement of the Starship I at Dallas, Texas at the NBAA's week long convention. Mike Melvill, one of the project test pilots, flew it to Dallas and demonstrated it at Love Field.

The Starship I was undoubtedly the major attraction at NBAA, and we wish Beechcraft much success with this, the most ambitious and most advanced business aircraft to come along in many years. We understand that Beech will be building and certificating the full scale Starship I as a composite aircraft. It is larger than their Super King Air 200.

Although the Starship is not for us homebuilders, sooner or later some of the technology that Burt has developed to produce the 85 percent scale demonstrator, will eventually filter down to the homebuilders and we will benefit from that. Much of its structure is moldless, using the hotwire core technique. It is 100 percent composite, and about half carbon fiber and half fiberglass (BID, UND and Safe-T-Poxy). Most of Scaled's personnel are EAA types with composite homebuilding experience. There is a rumor circulating that the Starship I (the 85 percent scale demonstrator) may be on the flight line at Oshkosh 1984 and may even fly an airshow there. Stay tuned!! We do not have any technical information about Starship, any questions must be addressed to Beech Aircraft.

OSHKOSH 1983

This year the Solitaire plans were introduced at Oshkosh with Solitaire in the final configuration on the flight line. Sally and Trisha volunteered to drive the RAF van towing the 30 foot sailplane trailer with Solitaire onboard. They took off from Mojave early in the week in order to be at Oshkosh in time to set up the RAF booth and get the Solitaire set up on the flight line. They drove 2,130 miles and both agreed that it was a fun trip. Mike Melvill and Michael Dilley flew Long-EZ, N26MS. Their trip was flown in one day with one stop for lunch at North Platte, Nebraska and a change of pilots. The second leg was flown in almost continuous rain and poor visibility, in fact a very circuitous route had to be flown to make it into Oshkosh late in the evening. The Long-EZ performed well and the flight time for the 1,700 mile trip was nine and a half hours, an average ground speed of 158 nautical miles per hour (182 mph). The route was Mojave direct Provo, Utah, direct Oshkosh. Burt flew in the next day in his Defiant with one stop at Laramie, Wyoming for fuel and lunch.

Picking the best Rutan Design this year was quite a challenge with 87 of Burt's designs present on the flight line. After much discussion, we were proud to announce that Don Prestin and Don Shaw, both of Santa Rosa, California with their virtually identical VariEzes were judged to win the Designers Award in a dead heat! Anyone who saw these two EZs would have to agree, the attention to detail was absolutely outstanding. Congratulations to both Dons and also to Bud McHolland for winning the Outstanding Workmanship award for his VariEze, N12XP.

The Solitaire was flown several times in the fly bys. The Defiant, the Long-EZ and the Solitaire were flown in an unusual 3-ship display during the evening 'showcase' fly bys. Dick Rutan flew Mike's Long-EZ to open the 1983 Oshkosh airshow and flew his usual super airshow aerobatic routine for the first half of the week with Mike Melvill flying the routine for the rest of the week.

Canard Pushers from 1 to 82

Oshkosh this year was not as big or as busy as in previous years, yet was plagued with accidents and incidents. Fortunately the only incident involving a Rutan design was when Ken Swain lost power in his VariEze on his way back into Oshkosh from Fond du Lac after the LBF race. See Ken's letter in this newsletter. We are happy to report that Ken was not injured in the forced landing, although his VariEze was substantially damaged.

Michael Dilley and Trisha drove Solitaire back to Mojave while Sally and Mike flew their Long-EZ to Jackson Hole, Wyoming for a two day hiking vacation. Due to a heavy schedule at his new company, Scaled Composites, Burt had to return home at mid-week.

The following aircraft were at Oshkosh, 1983

One Of A Kind

Dan Mortenson	Amsoil Racer
Nat Puffer	Cozy
RAF	Solitaire

Defiant

Burt Rutan	CA	N79RA
Fred Keller	AK	N39199

VariViggen

Ken Winters	OK	N31WW
Leonard Dobson	TX	N73LD
Bernard Duneman	MN	N33VV

VariEze

Ron Atkinson	IN	N3LV
Jim Bair	IA	N101MW
John Benjamin	PA	N40EZ
Roy Blaha	FL	N16PR
Dave Boldenow	IL	N203DB
Bob Boyd	ID	N98RD
Ed Braze	CA	N470EK
Bill Brin	CA	N9113A
Leonard Brown	NY	N9329A
Bill Butters	MO	N235LB
Dale Collins	FL	N224DC
Greg Coln	OH	N281
Robert Evans	WY	N46EA
Jack Fehling	FL	N444EZ
Harold Ferguson	NC	N2286A
John Fowler	IO	N82JF
John Frilling	IL	N28JF
Wes Gardner	CA	N13WM
John Good	TN	N66EZ
Ralph Hallenborg	CA	N141RJ
Jim Heitkotter	CA	N139EZ
Delmar Hoagland	IL	N1335D
Larry Hoepfinger	TN	N7RH

Canard Pushers from 1 to 82

John Jackson	MS	N2VE
Don Jones	TN	N300DJ
Elvin Kime	MO	N80EK
Roger Klemm	CO	N29ST
Clarence Langerud	TX	N91CL
John Levy	CA	N729BB
Wally Loewen	CA	N80WL
Bud McHolland	WY	N12XP
Byron McKean	TX	N57EZ
Robert de Malignon	AZ	N77AX
Michael Marker	NM	N22ZC
Gerry Mason	MI	N27GM
Ron Menzie	AR	N718RM
David Morgan	OH	N68M
Richard Pattschull	IO	N83RP
Martin Pavlovich	WI	N810TC
Frank Poplawski	TX	N60P
Curtis Poulton	OH	N79CP
Don Prestin	CA	N39DP
Gary Price	MA	N110NA
Daniel Quinton	MI	N1QD
Robert Ream	IN	N79BR
Robert Rutledge	IL	N28RR
Don Shaw	CA	N42DS
Garth Shearing	Canada	CGHYP
Don Shupe	CA	N39EZ
R.M. Sims	AZ	N4229G
Stephan Sorenson	CA	N118SJ
Shan Stewart	IL	N49T
Rivers Stone	SC	N37S
Ken Swain	NE	N4ZZ
Marc Tillia	Brazil	N32448T
Earl Wilson	CA	N999EB
Fred Wimberly	VA	N99FW
Bob Woodall	MD	N301RW

Long-EZs

Paul Adrien	NH	N46AA
James Brandt	AL	N103JR
Ken Clunis	CA	N345KJ
David Domeier	CT	N26JD
Diel/Corley	CA	N82CD
Darwin Esh	WI	N98CD
Charlie Gray	FL	N211LE
Tom Garrison	TX	N158TG
Neil Hunter	FL	N141NH
Bill Hinckley	VA	N55LZ
Jim Hightower	MS	N234LE
Carlin Johnston	TX	N82CJ
Judge King	MN	N350JK
Ron Lueck	FL	N1177N
Lee/Andrich	CA	N373JH
Robert La Bonte	NH	N369R
Mike Melvill	CA	N26MS
Herb Sanders	TN	N81HM
George Scott	TX	N468DS

Frank Tifft	CA	N307EZ
Tom Williams	CA	N8EZ
Williams/Cortner	NM	N95JV
Joe Yasecko	FL	N305Y

SOLITAIRE NEWS

SSA Homebuilder Workshop - Labor Day weekend is the Soaring Society of America's annual Homebuilders Workshop. This west coast version of the sailplane homebuilders "Oshkosh" was held at Fantasy Haven glider port in Tehachapi. We flew the Solitaire from Mojave over the ridge to the Tehachapi glider port on Friday afternoon. After landing we decided to try out the gravel runway for take off. The Solitaire had no problems getting off although it took about 900 feet of runway. Climb out was adequate and we were at pattern altitude on down wind opposite the numbers. This was a hot September afternoon, off a gravel runway at 4,000 feet elevation.

Saturday morning, Burt gave a presentation on the Solitaire and brought along John Roncz the designer of the airfoils used on the Solitaire. The talk was informative and left plenty of time for a question and answer discussion. There was a slide show presentation which dealt mainly with the construction techniques. After the presentation, Burt and John had to fly back to Mojave in the Grizzly. Michael Dilley and Trisha Palmer spent the rest of the weekend talking to the builders and showing off the Solitaire prototype. Later on Saturday, RAF in conjunction with Dave Lund of SSA put on a hands on workshop, showing both the hotwiring and fiberglass layup techniques used in the Solitaire.

Solitaire flew on Saturday at 1:00 p.m., demonstrating the self launch take off capability of the KFM engine. It was about 100 degrees with a density altitude of 7,000 feet. The Solitaire was able to get off the gravel runway.climb out and go soaring with the other sailplanes. The nice thing about the Solitaire was, that there was about a 40 minute wait for a tow plane, (this of course happened during the best time of the day for thermaling but the Solitaire was able to taxi out and take off

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totally unaided with no wait. Later Saturday afternoon RAF gave another demonstration of building techniques.

Sunday was basically a repeat of Saturday with Solitaire flying in the morning and afternoon. The first flight was at 9 am before much thermal activity had started. Because the Solitaire is so inexpensive to run, it is possible to go out and make an early morning flight just to be in smooth air over a beautiful mountain, just for the view and also to 'sniff' out the thermal activity.

Sunday afternoon, Solitaire was able to show off some of its thermaling ability and actually gathered a crowd when other sailplanes saw it doing well in an area of the valley that none of the other sailplanes had tried. All landings were made with the engine folded away because

it is easier to make an approach with the very powerful spoilflaps than using the throttle for glide path control.

The SSA had composite introduction kits on hand from Aircraft Spruce for sale, the idea being that people could not only watch a demonstration of the techniques but could do their own 'hands on' layups with an experienced person to help them get started with the right techniques. To demonstrate the hot wire cutting, we had members of the audience do the cutting with the RAF crew watching. This was to demonstrate the speed with which someone can be taught to use the hot wire cutting method. The parts, by the way, came out great!

Monday saw more Solitaire flying for the people who had attended the seminars and did not get to watch the Solitaire fly. This was a pleasant event where most of the people are on a first name basis. By power plane standards it was a miniature event but the enthusiasm was evident on the faces of the people who were there. Anyone interested in sailplane homebuilding would be well advised to attend this event.

The RAF crew would like to thank the operators of the Fantasy Haven gliderport for their hospitality.

The Solitaire Program
The Solitaire program has been moving along at a rapid pace since the last newsletter. The Solitaire put on showcase flybys at Oshkosh about every other day of the convention, more about that in the Oshkosh section. The prototype has been to the SSA Homebuilders Workshop at Tehachapi, to the Brown Field flyin in San Diego and had lots of hours and several more pilots checked out in the prototype here at Mojave.

Deliveries
Task Research has started shipping Solitaire kits! They have set up with two sets of fuselage shell molds and have been pulling parts. We have seen the spars and they look very nice. The seat pan is a real beauty, having built the original in place with pour-in-place foam, then glass and finally digging out the foam, I can appreciate the way this part fits and how easy it is to install. Task Research was leaving for the Eloy, Arizona flyin at the date of this writing with the number 002 Solitaire. They had the bulkheads fitted and the shells trimmed but not bonded. They were going to the flyin to show the ease of assembly of the prefabricated parts.

Ken Brock Mfg. is a little behind Task on parts availability. They should be able to ship all the Solitaire airframe parts starting about mid-November. This should not slow down the builders very much since there are very few Brock parts in the first few chapters of the plans.

The Owners Manual is almost written and should go to the printers in a week or two. We have a small amount of flight test data left to acquire before we finish up.

The Solitaire prototype has 160 flights now and we are more than pleased with the entire design. The KFM engine has not failed to start or given us any trouble since we installed it. Flying the Solitaire is fast becoming the primary sport here at RAF.

Brown Field Flyin

RAF attended the Brown Field flyin in San Diego. This is an ex-military airport right on the border between Mexico and the USA. It has long runways and lots of room for aircraft and people. The event was well organized but unfortunately the weather stopped many people from showing up. The L.A. basin and the Tehachapi mountains were socked in so very few aircraft showed up from out of town. It rained some but the field was open all day.

Michael Dilley and Trisha Palmer drove the trusty RAF van down to Brown Field with the Solitaire in tow (in the trailer) on Friday. Once there, we found lots of activity setting up for the flyin. We left the Solitaire in the trailer overnight.

The next morning was set up time for the Solitaire and a booth to display the Solitaire plans. Solitaire was flown on Sunday twice mainly to demonstrate the take off and climb capability. It was not possible to demonstrate the soaring capability since Brown Field is a control tower and there are usually four or five aircraft in the pattern at one time. We did, however, fold the engine in and out and restart in the air, time after time. We were able to do high speed passes down the runway then pull up, extend and restart the engine.

There was a small airshow, with a great aerobatic sailplane demonstration which finished with two loops that were so close to the ground, they probably had to mow the lawn before he could perform! Overall, the flyin was disappointing because of the weather. It was well organized and hopefully next year the weather will be kinder.

The Solitaire was entered in the aircraft judging and won awards for both Best Sailplane and Best New Design. We hope to be able to return next year.

IVHC Flyin to Ruth, California
As one of the highlights of the year, this flyin was just plain super. Ruth is a working ranch in the northern California coastal range. The runway is hard surface, roughly parallel to the river and down in the bottom of a steep, deep valley. This makes for some interesting approaches, especially from the south. The 'normal' approach is to drop down into the river valley 3 or 4 miles from the runway. Follow the river, getting lower and lower, until you come around the last bend in the river and there is the runway, right in front of you. It sounds a little difficult but none of the 14 VariEzes and Long-EZs had any difficulty.

Barbara Wilson did the organizing for this one and she deserves a standing ovation. Not only did Barbara do the work, but she drove 7 hours so that we would have all the popcorn etc that we needed! It was a really outstanding weekend with lots of good food, friendship and lots of "hangar flying". Most every one went bicycling, hiking, horseback riding, swimming, jogging and flying. We all flew to Shelter Cove on Sunday, right on the coast, where we had brunch and did a little beach combing.

Some 'brave' souls even went swimming. Anyone who flies an EZ and is not a member of this group, should get with the program and join up!! The IVHC will be organizing a trip to the Baja peninsular over the

Christmas/New Year period, so stay tuned. The following people flew into Ruth to make a fabulous weekend.

Earl and Barbara Wilson	CA	VariEze
Chuck and Joan Richey	CA	VariEze
Wes and Millie Gardner	CA	VariEze
Jerry and Karen Gardner	CA	VariEze
Bill and Julie Lermer	CA	VariEze
Les Faus and Joanne	CA	VariEze
Don and Darlene Young	CA	VariEze
Jim and June Highkotter	CA	VariEze
Joe Moore	CA	VariEze
Steve Sorenson & family	CA	VariEze
Shirl and Diane Dickey	UT	VariEze
Bruce and Bonnie Tifft	CA	Mod. Long-EZ
Mike and Sally Melvill	CA	Long-EZ
Bob Pugh	CA	Long-EZ
Bob and Joan Hansen	CA	C-172/Long-EZ
Chris de Brichambant	France	Long-EZ builder

BUILDER HINTS

The following was sent in by Tom Williams.

"One of these days, in the confusion that can happen when landing, one of us less than perfect pilots could hit that gear warning DEFEAT switch and then ignore the gear warning light (if you have one). That's likely to ruin more than one day fixing your nose. I have designed an electronic circuit which will DEFEAT the DEFEAT in 60 seconds. The relay shown in the circuit is the same one shown in the plans. The timer chip and all of the other components are available at Radio Shack or just about any electronics supply store. The 60 seconds can be varied by changing the values but I believe you will find the 60 seconds just about perfect; longer might not give time enough to get your gear down on final and shorter will drive you up the wall in a long glide".

DIAGRAM OMITTED

Side Consoles
Make and fit all side consoles. Do not permanently install them yet. Make your plywood parts CS109 and CS118 and glue them to the side of the fuselage with 5 minute in the appropriate positions, using the side console for location. After the 5 minute cures, layup 1 ply of BID on each side of CS109 and CS118 (fore and aft) and lap onto the fuselage side at least 0.5". Allow to cure. Now make CS108 and CS118 (phenolic bearings) and bolt these into place. Install all of the pitch/roll control system from the front stick to aft of the firewall. Also install the fuel valve and all fuel lines. Also install conduits for electrical wiring. Do all of this before the side consoles are finally epoxied and glassed into position.

Front Seat Bulkhead Location

For shorter pilots, Mike Melvill moved his front seat bulkhead forward 2". He did not change the angle nor anything else. The landing brake is installed 2" forward of plans. In other words, it is still related to the front seat bulkhead per the plans. The landing brake handle position and right side stick controller were not changed. This resulted in an excellent fit for Mike (5'9" tall) and also for Sally (5'4" tall) and gave them a larger rear cockpit and helped the aft cg problem, since they used a starter and alternator. The landing brake, positioned 2" further forward, works great with zero pitch trim change.

Pitch Trim - VariEze and Long-EZ
While most VariEzes and Long-EZ have a rather mild pitch trim change in rain, some are less mild then others. Try this: scuff sand your canard using 500 wet or dry (wet). Sand only in a chord wise direction, until you have a uniform dull look. Ken Clunis did this to his with surprisingly good results.

Shimmy Damper - VariEze and Long-EZ
If your nose wheel shimmy damper is not holding consistently, check to see if the phenolic "piston" is tight in its vertical hole. If so, ream the hole about .005" oversize to allow a nice free fit on the phenolic "piston". Reassemble, being certain to use the heavy duty spring called out in CP 30, page 4 and this problem should be solved.

Fuel Leaks into Outboard Wings - VariEze and Long-EZ
We have now had reports from three different flyers, that they have had small pin hole leaks in the outboard ribs of their fuel tanks, and that fuel had somehow seeped into the outboard wings. Small pin holes in the root rib of the outboard wings have allowed fuel to attack the styrofoam in the wings. This is a serious situation, since the wing structure requires the foam core for buckling support of the wing skins.

The solution of course, is to be positive that your fuel tanks do not leak and any fuel stains observed near the wing would require removal of that wing and careful checking for any loss of foam structure. Fuel will instantly melt styrofoam and will find its way through the smallest pin holes if its allowed to. If this happens, a repair requires removing all of the melted foam, and cutting back into good foam. Then a block of foam must be cut and fitted, then micro'ed into this void. A possible alternative would be to use "pour-in-place" Liquid X foam or equivalent. Sand the foam to the original shape and do a standard fiberglass repair.

Carb Heat Muff
Aircraft Spruce sell an excellent little carb heat muff. A simple tube that can be slid onto the Brock exhaust system, right side, forward header and clamped in place with two worm gear clamps. Ken Clunis turned this in and it is easy to do and works great.

Cutting BID Tapes
Try rolling the BID cloth into a 1" diameter roll at 45 degrees to the selvage edge, having previously carefully straightened the fibers. Now use a large sharp pair of shears to cut off 2" wide rolls. Presto! Your 2" wide tapes are ready to use and even rolled up for you.

Aluminum Corrosion

Out here in the desert corrosion is not a problem. Some builders however, do live in highly corrosive environments. Rodie Rodewald is one. On the north shore of Oahu Island in Hawaii, where the biggest surf in the world breaks is where Rodie keeps his VariEze and Long-EZ. The air is literally heavy with salt spray all the time and Rodie has found exposed aluminum parts, not anodized, will corrode. He strongly recommends anodizing and insists that it is easy and fun to do. All you need:
1 gallon plastic jug cut off to make a bucket.
1 gallon of battery acid (H_2SO_4) at a specific gravity of 1.10.
A lead plate a little larger than the parts to be anodized.
12 volt battery charger (6 amps is best).
Pure, soft aluminum wire.
Trisodium phosphate (TSP) available at hardware stores, diluted .80 ounces per gallon of water.

Cleanliness is very important to success. He used wooden tongs and chop sticks to handle all parts after cleaning and proceeded in the following way:

Degrease all parts to be anodized.
Heat TSP to boiling, cool to just under boiling, immerse parts 3 minutes.
Water rinse avoiding touching the parts.

To anodize:
Positive lead to parts.
Negative lead to lead plate. Use the aluminum wire. A good contact is the secret to success.
Gas bubbles evolving from the lead plate proves that anodizing is occurring.
Leave parts in the anodize process 25 to 30 minutes.
Water rinse.
Boil parts for 10 minutes in tap water to seal the anodizing.

The only caution note is to be careful with the acid. It is not a strong acid, but acid is acid and can burn, therefore use personal protection of skin and clothing and in event of an acid spill, wash thoroughly in baking soda and water.

Spark Plugs for Hard Starting Engines - VariEze and Long.
Bill Price, a VariEze flyer with over 450 hours on his VariEze, reports that for 400 hours his engine was a real beast to start, particularly while hot. He switched to platinum plugs and reports that his engine is now pure pleasure to start, idles smoother and runs better. Platinum plugs are quite expensive, but last a long time. Mike Melvill had REM40E massive electrode plugs in his Long-EZ engine, an O-235-L2C (as called for by Lycoming) and found that every 10 to 15 hours the bottom plugs would lead foul. Instead of platinum (which may have worked), Mike used Champions REM37BY (extended tip) and the problem disappeared. In fact, the plugs were not cleaned for 260 hours, with no problems.

Prop Damage - VariEze and Long-EZ

Remember, flying a pusher airplane, anything that comes off the airplane might possibly go through the prop. This includes cowling screws, loose pieces of safety wire, nuts and washers left loose in the cowling, even wrenches inadvertently left in cowling! Be careful. Be conscientious about working on your airplane. You are the qualified mechanic doing maintenance on the airplane and it is absolutely your responsibility to do the best work you can. A cowling screw or a fuel cap going through the prop, can cause sufficient damage to the wooden prop, that you may have to land and wait for a replacement prop.

Engine Alignment - VariEze and Long-EZ.
The engine should be mounted with the crankshaft center line right on B.L. 0 looking down at a plan view. There is no side to side offset. Looking at a side view, the engine is mounted with down thrust. That is to say, the prop flange is higher than the magneto end of the engine. Ideally this is a 2 degree angle. Plus or minus 1 degree will be okay. When you install your engine mount, do not assume that the four forward tubes are square and true. Clamp the mount to the aluminum extrusions and measure from the firewall back to the flanges (conical mount) or to the donuts (dynafocal) and do not drill in the mount until you have it positioned correctly.

Prop Bolts - VariEze and Long-EZ.
If you are using a standard Brock prop extension with threaded drive lugs and crush plate, and a prop that is approximately 3 3/4" thick at the hub, (Ted's, B&T, etc) you will need 6 prop bolts. AN6H-51A will work fine and are much cheaper than the AN76 prop bolts.

Worm Gear in Nose Gear Mechanism - VariEze, Long-EZ and VariViggen
If you buy the worm gear from Boston Gear, it will not be a solid gear, but will have holes in the hub area. This can still be used, but must have the holes filled first. We simply used flox. See sketch.
SKETCH OMITTED

If you would prefer a solid gear as shown in the plans, the only source we are aware of is from Ken Brock Mfg. Brock also sells this gear for VariViggen builders, for the main gear retract mechanism.

Front Control Stick - Long-EZ
Be certain that the lower bolt in the control stick can not catch on the rudder conduit at full left aileron deflection. Check this carefully before next flight. One builder had this occur in flight. He got quite a scare before he forced the stick right and tore the conduit off the fuselage side.

Sticking Fuel Valve - VariEze and Long-EZ
Hank Ashmore has found an excellent replacement for a VariEze/Long-EZ fuel valve. It is a Gerdes products fuel selector valve, and is found on Beech Musketeers, Sundowners, Sierras etc. It is a perfect match for the EZ valve and does not stick. Hank found his at an aircraft salvage yard and paid $20.00 for it. Unfortunately they cost around $125.00 new!! We are not advocating that everyone should run out and get one, but for those flyers with a particularly nasty sticking valve problem, it may be an alternative worth considering.

Corner Tapes - VariEze and Long-EZ

Installation of BID corner tapes, such as in corners between fuselage sides and bulkheads can be a time consuming job. Try this: spread out a piece of aluminum foil (such as Reynolds). Layup the BID cloth, usually two plies, large enough to cut all the tapes you are going to need, onto the foil. Squeegee this layup out to a good layup. Now cut your 2" wide tapes out of this layup, cut through the glass and aluminum foil. Sand and paint a coat of epoxy onto the area to be layed up over, then with your fingers, bend the aluminum foil to form the "tape" into an angle to fit into the corner. Carefully position it and lightly squeegee or stipple it into place. Peel the aluminum foil off, stipple to eliminate any small air bubbles, peel ply the edges and presto, a perfect tape. Really works well.

Wing Fitting Ventilation - Long-EZ
The outboard main wing attach fitting recesses in the wings should be ventilated to avoid an accumulation of condensation. Drill a #30 hole in the bottom cover. Remove the top cover and drill a hole in the lowest point of the recess such that it will break into the recess underneath the wing. This hole should allow a soda straw to slip through. Work a little micro into this hole and slip a soda straw through. Allow to cure. Now carefully cut the soda straw flush with the bottom of the recess. Silicone the top cover back on. This will allow the two covered areas to "breath" and eliminate condensation, which could corrode the wing bolts. **SKETCH OMITTED**

BUILDER SUPPORT
Builder support at RAF lately has been handled by Michael Dilley, since Mike Melvill had been involved in the very busy flight testing of Burt's new design, the Beech Starship I. Michael came to RAF over two hears ago and has been involved in the finishing stages of the Grizzly, all phases of construction of the Solitaire, including the writing of the plans and of course he flies Solitaire. A few months ago, he started building his own Long-EZ at home, and of course he regularly demonstrates the prototype Long-EZ and gives the builder rides on Saturdays. In addition Michael was a primary builder of the Amsoil Racer. He has previously owned a Taylorcraft and a BD-4. Michael is doing sterling work handling almost all builder support including VariEze, Long-EZ and Solitaire. Thanks Michael, we could not do it without you!

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of

recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

No VariEze or Long-EZ plans changes this newsletter.

SOLITAIRE PLANS CHANGES

SPC #15, MEO
Section I, Page 2-2. Add to the Spruce and Wicks parts list: 2 each K3000-3 nutplates 2 each K3000-4 nutplates 1 each spruce - 3/4 x 3/4 x 48"

SPC #16, MEO
Section I, Page 6-1, Step I. Sentence 9, delete the "and SRH-8 inserts" and add "install two K3000-3 nutplates onto SRH-10". Sentence 11 should read "wipe a thin coat of wax onto two AN4 bolts and two AN3 bolts". Change the SRH-8 in the next sentence to SRH-10.

SPC #17, MEO
Page A-7. WL21 on jig 58 and jig 105 should be WL20.

SPC #18, MEO
Section I, Page 8-1, Step I. The elevator cores should be cut to 34" x 4.2 x 7.0.

SPC #19, MEO
Page A-21, Section J-J. SSF-3 pivot bolt water line is 24.5 not 25.5 as called out.

SPC #20, MEO
Section I, Page 18-3, Figure 18-8. Canopy latch does not shown wood inset into the canopy frame as called out in the instructions. The wood is 1/4" birch plywood.

SPC #21, MEO
Section I, Page 5-1, Figure 5-6. Install the pitot tube on the right fuselage half at the water line and fuselage station not the left half as shown. We recently moved the position of the tow hook and had to reposition the pitot tube to make it work.

SPC #22, MEO
We forgot to build the fairing block between B.L. 82.5 and B.L. 93.5 on the wings at the trailing edge. This should be installed in Chapter 19 after the ailerons and spoilflaps are working. Use a block of scrap blue styrofoam and cut it as shown.

SKETCH OMITTED

Remove the wings from the aircraft and disassemble the two SCS-110s from each wing along with the SCS-110A and SCS 109. Slide the SCS-211 tube inboard under the spoilflap. This leaves the area between the spoilflap and the aileron clean. Tape the trailing edge of the wing and the edges of the spoilflap and aileron. Bondo the ailerons into position with the aileron to wing assembly jig on Page A-17. Fit the foam block against the vertical shear web and between the aileron and spoilflap. Five minute the block in place and using a sanding board sand the top side of the foam to shape. This shape is basically a straight line between the aileron and spoilflap at any fuselage station. When the top is to contour, renew the tape around the edge of the foam and slurry the foam. Peel ply the last 1/2" of the trailing edge and layup 2 plies of UND at + 45 degrees lapping onto the taped area of the wing spoilflap and aileron. Knife trim on all the edges when ready. Turn the wing over, gray tape the wing, spoilflap and aileron and sand the foam to shape on the bottom. Pull the peel ply along the trailing edge, renew the tape edges and layup the bottom skin with 2 plies of UND at + 45 degrees. Fill the joggle at the trailing edge with micro, cover with peel ply and squeegee to contour. Knife trim at the edge of the foam all around when ready.

Remove the fairing block from the wing and reinstall all the hardware to activate the aileron. Remove the jig fixture to allow the aileron to move. Dig out the foam enough to allow the belcrank mechanism to operate throughout its range with adequate clearance. Do not remove all the foam. It is acceptable to remove all the foam down to the glass skin in areas where necessary. Remove the foam 0.5" on the ends to make a rib in this area. Slurry the foam and layup 1 ply of BID inside, lapping as necessary to allow it to follow the contour. Be sure and leave lots of room for the SCS 211 control tube. Knife trim all around when ready.

Fit the fairing back in place and be certain you have 1/16" clearance between the aileron and spoilflap. Sand as necessary. Micro the fairing in place, use fairly dry micro and be certain none drips onto the controls. After cure sand 1" onto the wings and the fairing for bond and apply 1 ply tape of BID at 45 degrees lapping 1" onto each part top and bottom. These should also lap onto the fairing above the aileron and the hinge line below. Peel ply the edges for transition.

SPC #23
Section I, Page 2-2. Add to Spruce and Wicks parts list - Styrofoam, blue 2 lb/cubic ft 4 x 24 x 48 - 1 each

SOLITAIRE BUILDER HINTS
Builder Hint #1
Solitaire Com Antenna - The best place for the comm antenna on a Solitaire is in the vertical stabilizer. The antenna is available from

Radio Systems Technology, 10985 Grass Valley Ave, Grass Valley, CA 94945. The

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cost is $15.00 unassembled or $25.00 assembled with BNC connectors. This is the same antenna that is used on the Long-EZ and has been extremely successful. The antenna uses copper foil with RG58U lead-in wire. It does not require a ground plane. To install the antenna, cut two strips of copper foil 20.3" long. Remove the protective backing and stick the foil to the inside of the vertical tail on the right fuselage half as shown and leave about 1/8" between them. Do not tape down the last 1" where the 1/8" gap is yet. Solder the center lead of the lead-in wire to the upper foil protecting the fuselage from excessive heat and the braided outside wire to the lower foil, with the three ferrite balums on the wire as shown. These are spaced the same distance apart as they are thick. Stick down the last 1" of foil and be certain they don't touch or short out. Layup a 1" wide ply of BID +45 degrees over the foil and onto the lead-in wire to attach the ferrite balums in place. Use a 2" x 2" BID patch spaced 8" apart to hold the lead-in in place. Run the lead-in down to the static line and beside it forward to the instrument panel. This antenna should be installed in the same step as the static system Page 5-1, Step II.
SKETCH OMITTED

Builder Hint #2
When installing the bulkheads into the fuselage, note that F.S. 72 has a glass to glass area, do not drill nail holes to index the bulkhead in this area because the bulkhead is not on the scribe line at this point.
SKETCH OMITTED

Builder Hint #3
When trimming the fuselage halves for assembly, the overlap joggle on the half should be trimmed to 5/8" as shown. When the two fuselage halves are fitted together the width of the total joggle should be 1.5"
SKETCH OMITTED

CAUTION - Long-EZ
Note that the engine section of the plans, Section IIL updates Section I of the plans. Do not do any work in the area of engine mount installation, brake master cylinder installation or anything aft of the firewall until you have Section IIL in hand. Also - do not install the aluminum engine mount extrusions until you have the engine mount at hand and can clamp it to the extrusions while they cure in place. This assures a perfect match of engine mount to extrusions.

CAUTION
Several builders have been leak checking their fuel tanks by pressurizing them, or pulling a vacuum on the tanks so strongly that they cracked their tanks. Be careful! The only safe way to leak check your fuel tanks, is to plumb an altimeter into the vent line and suck or blow an altitude change of a maximum of 1500 feet. Use your mouth to do this. Do not use a vacuum pump. There is an awful lot of square inches of surface area inside your tank, and even a relatively small

change in atmospheric pressure per square inch, can put hundreds of pounds of force on your tank.

CAUTION
There is a product being sold that supposedly can be used in a liquid form and painted on in place of the recommended firewall. RAF does not approve the use of this material on a VariEze or Long-EZ. While this material is fire proof, it has virtually no insulating qualities. This means the cockpit side of your firewall bulkhead can be almost as hot as the engine side during a fire. The spontaneous flash point of the epoxy system is only about 850 degrees F, so it is possible to have a fire inside the cockpit area, even thought the fire did not burn through. The insulating qualities of the fiberfrax is required to keep the temperature on the cockpit side of the firewall bulkhead below the flash point of the epoxy.

LONG-EZ CLUBS

Arnie Ash, RR #5, Davenport, IO, 52806, would like to form a Long-EZ group interested in construction etc. Anyone in Quad Cities area of Iowa/Illinois, contact Arnie.

Sunbelt Long-EZ Club.
Contact: Pete Petrie or Jim Hooks,
(919)739-3302

LONG-EZ Squadron 2
Squadron 2, the Long-EZ builders/flyers club, is going strong at Santa Monica Airport and now has 30 builder members. They meet at Santa Monica Airport at Claire Walter's Flight Academy on the 2nd Wednesday of every month at 7:30 pm. Squadron 2 has aims similar to those of Squadron 1. It is a builder's support club to provide assistance by builders to builders. Those who have a Rutan registration number are welcome to join. Anyone considering a Long-EZ project is welcome to come visit as a guest.
Long-EZ Squadron 2
3021 Airport Avenue
Santa Monica, CA 90405
(213)398-5652 or 454-9877

Scaled needs a Composite Designer
Capabilities required are emphasis on the type of structures used on the Long-EZ rather than the big industry autoclave composites. Ability to do stress and strain analysis, draw structural drawings and then assist in building, are all required.
Contact: Herb Iversen
Hanger 78
Mojave, CA 93501

FOR SALE

Continental 0-200, 1,500 hours total time. Running fine when removed from a Cessna 150. No prop strike. $2,000.00 with generator and Slick mags.

Contact: Aircraft Salvage and Parts
12000 South Prarie
Hawthorne, CA 90250
(213)973-5153

Lycoming 0-235 CIB. 187 hours since major. Bendix mags. Log books $3,500.00

Contact: Max Lopez
811 North High Street
East Haven, CT 06512
(203)469-0726

Lycoming 0-320-D3G 160 hp. Log book. $3,00.00

Contact: Alan McPherson
P.O. Box 703
San Jose, CA 95106
(408)292-4332

Lycoming 0-290-G Converted to -D, 30 hours since major. MA3-SPA carb, mechanical fuel pump, Slick mags, shielded harness and prop flange reinforcement. $2,800.00

Contact: Jack Huffamn
15737 E avd Y-4
Llano, CA 93544
(805)944-4790

Continental C90-16F, 400 hours total time since new with all accessories. $3000.00

Contact: Jay Warren
(916)622-4115

Lycoming O-235-L2C, brand new, $8300.00

Contact: Pat Saffron
(216)254-4683

Task Research Fuel Strake Sale!

50 Sets Only, Order by Mail only.
No Phone Orders, No exceptions!
Sale starts November 1, 1983

Regular Price - 16 pcs. $984.00
Sale Price - 16 pcs. 884.00

50 percent deposits required with place of order.
No orders will be taken before November 1.

WANTED - VariEze Nosegear strut and fittings. Also parts for landing brake, ailerons, controls etc.

Contact: Tom Wilson
2643 Any Ct.
Duluth, GA 30136
(404)476-3264

SHOPPING

Aircraft Spruce now has in stock the electric cockpit heaters as tested by Mike Melvill in N26MS. Also a substitute for the now extinct Disston Abrader, a handy little tool for sanding and filing glass and foam. Also a new type of spray-lat for protecting plexiglass canopies. We tried it and it works great.

Plans for the NACA flush inlet, for Long-EZ and VariEze. $20.00 for a set of drawings.

Contact: Tim Gehres,
105 Apple Blossom Ct.
Orlando, FL 32806
(305)275-7897

Harold "Mule" Ferguson made a video tape of Oshkosh 1983. Lots of EZs $43.00 in VHS or Beta.

Contact: Mule Ferguson
(919)921-3019

A 3D display, processing and plotting program for Apple II graphics. $75.00 with program and documentation, as seen at Oshkosh at the RAF booth.

Contact: Turtle Software
8526 Calmada
Whittier, CA 90605

Aero Record - This is a builders logbook which covers all current requirements for record keeping during construction and can be used as an engine, airframe, propeller log book after the aircraft is flying. The logbook is in ring binder form and new pages can be added as needed. The book was designed by a homebuilder who also happens to work for the FAA inspecting aircraft. This book has been set up so you fill in the blanks and all the information the FAA wants to see is there.

Contact: Aero Record,
6854 Antiqua Way
Sacramento, CA 95831

Program for the TRS-80 "pocket computer". This program performs the functions of an owner's manual and all calculations, cg, etc. for preflight and flight operations for a Long-EZ.

Contact: Bob Hansen
(213)341-9477

OVERSEAS BUILDERS

For builders in the UK, Graham Singleton has smoked and clear canopies for 140 pounds. Also one set of Lycoming Long-EZ cowlings in Kevlar for 180 pounds.

Contact: Graham Singleton
Millthorpe Lane
Holmesfield, Sheffield
England.

European Builders - Dane Kurth has lots of EZ materials in stock, PVC foam, urethane and styrofoam. Fiberglass, UND and BID. Dane can

translate plans into german. Also, one Continental C-90 engine. Regular orders to the USA.

Contact: Dane Kurth-Rowe
CH 3292 Busswil
Switzerland
032-842289

VARIVIGGEN NEWS

For the first time there were 3 VariViggens present at Oshkosh. Bernard Duneman from Minnesota flew his SP wing version with a forward sliding front canopy of his own design in. Ken Winters from Oklahoma flew his 180 hp, SP wing version with the spectacular paint job in and Len Dobson flew his standard composite wing 180 hp model in from Texas. To cap it all, these three Viggens flew a three ship fly by in the Oshkosh pattern, what a sight. My own Viggen, N27MS was left at Mojave this year, it was the first Oshkosh since 1978 that she did not fly in. Arthur Schwartz had intended flying his Viggen in, but unfortunately he had a freak accident with it and damaged it severely enough that there was no way to make it.

Arthur reports that on landing, the rod-end bearing on the right main strut (MG34) failed. This allowed the trailing link gear to collapse enough to lock up the right wheel. This dragged the airplane off the runway, where the left main gear and nose gear were torn off. Arthur was shaken up and sustained a few bruises, but otherwise was unhurt. I have since heard from Frank Stites, who recently visited Arthur, that he is repairing his Viggen. Arthur, by the way has over 250 hours on his Viggen.

Frank Stites has completed his Viggen and it looks beautiful. He has the SP wings and a Lycoming 0-320 (160 hp) engine and it is ready for first flight. Frank's Viggen weight 1004 lbs. empty. It should be quite a performer!

The Viggen Club list has continued to grow and I believe has made a large contribution to the Viggen builders. I have received copies of quite a few interesting letters that some of the listed builders have written to each other. This is an excellent method of transmitting ideas, short cuts, builder hints and flying info. I strongly encourage anyone building a Viggen to send their name, address and phone number to me at RAF and it will be included on the list. The list is sent out to all on it, each newsletter time.

VariViggen project for sale,
Contact: W.K. Armstrong, jr.
16114 Bougainvilla,
Friendswood, TX 77546
(713) 482-0265

LORAN C IN AN EZ?

At Oshkosh this year there was much talk about Loran C in the fiberglass airplanes. There were even a couple of forums on the subject. It is quite obvious to me at least, that there is much confusion among even the so called experts. We at RAF, do not have a

Loran C in any of our airplanes, but we do receive quite a lot of mail on the subject. Much of this mail is contradictory and even more confusing. Some builders report success by as simple a means as using one rudder cable for an antenna (insulated at the root of course). While this has worked for one or two people, it has been a dismal failure for others. It seems to be a function of how close you live and fly to a strong signal.

The antenna called out in CP 37, page 3 still seems to be the best so far. The big thing appears to be that a ground plane of some kind is required. The larger the ground plane, the better the performance. How to do the ground plane is the trick. Several competent radio specialists are working on this problem and we will report on it as we hear the results. One of the problems, as called out in CP 37, page 3 is electrical interference and anything you can do to shield every wire and any electrical noise source is going to help. For this reason, a Loran C in a VariEze with no electrical system (no starter, no alternator) just a battery and a Nav/Comm with a solar panel to trickle charge the battery, will sometimes work reasonably well, particularly in the vicinity of strong signals. However this may break up and drop the signal in other parts of the country. Obviously the Loran C is the way to go and the sooner someone comes up with a good workable solution to the problem, the better. Anyone who has a Loran C that works well even on extended cross countries, please let us know and we will try to keep everyone reading the Canard Pusher informed.

PROPELLERS FOR LONG-EZS

Since last newsletter, we have flight tested 7 different props from four different manufacturers. Most of these props work well, keeping in mind that on an airplane as clean as a Long-EZ, any prop is a compromise. After all, we stall at 51 knots and we can indicate 165 knots at sea level. That is a very large speed range for a fixed pitch prop to handle. So, in order to get acceptable take off and climb performance, we have recommended that a minimum of 2400 rpm static should be available. This is done on a gravel free patch of taxiway, brakes locked, full throttle and mixture leaned to best power (max. rpm). Our experience has shown that if you don't have at least 2350 rpm static your take off run will be excessive, particularly at gross weights and even more so at high density airports.

Now at the other end of the scale, if we have our 2400 rpm static, obviously, with a fixed pitch prop, we will be able to over rev the engine at high speed, particularly at low altitude. Our criterion here has been to accept a full throttle, best power mixture at 7500 feet (MSL) in level flight with 2900 rpm as our optimum goal. This is 100 rpm over the engine manufacturers red line, but we use a very lightweight prop, and our static thrust is half what these same engines see in the factory airplanes they are installed in. We have been running these engines at high rpm and low manifold pressure for a long time, with no problems. So, the optimum prop would be one that turned 2400 rpm static and 2900 rpm at full throttle at 8000 feet. This is a difficult design goal for the prop maker and each one is different. Also each individual Long-EZ is different and a prop that may work perfectly on Mike's Long-EZ may not be as good on your own Long-EZ.

With all of this in mind, and with no intention to try to recommend one manufacturer's prop over another, we present a summary of the results

of the tests of these different props. All tests were done on N26MS. Choose a prop for your airplane based on your expected flying conditions. If you are based at a short field, or high density airport, you would not choose the same prop as a person who was based at an 9000 feet long runway at sea level who would fly mostly high speed cross country to similar airports. Probably the best bet is to have two props!

Manufacturer	Size	Static RPM	RPM at max power at 7500' MSL
Hendrickson	62" x 66"	2360	2900
B & T	63" x 67"	2300	2920
Sensenich	64" x 72"	2150	2860
Great American	62" x 62"	2520	2925

There is only a 3 mph true airspeed difference in these four props at the top end. The fastest props turn the highest rpm generally, the best take off performance comes from the prop turning the highest static rpm. All of these props are of excellent quality, but vary considerably in blade design and method of measuring pitch. Leading edges also vary, some have solid polyurethane leading edges which withstand rain erosion very well, others have epoxy leading edges, while others have a wrap of kevlar. All will hold up quite well in rain, if you throttle back to 2400 rpm or so to keep the tip speed down.

Ted's Propellers,
9917 Airport way,
Snohomish, WA 98290
(206)568-6792

B & T Propellers,
8746 Ventura Ave.
Ventura, CA 93001
(805)649-2721

Great American Props
1180 Pike Lane #5,
Oceano, CA 93445
(805)481-9054

John Benjamin Propellers
P.O. Box 216
East Petersburg, PA 17520
(717)569-2687
(Made by Sensenich)

NOTE FROM B & T PROPELLERS
"First of all, let us say many thanks to all of our patient customers. A variety of circumstances during this last year have definitely thrown our prop order list way out of kilter. Since getting so far behind on the orders, we've simply been trying to make propellers for the builders that have notified us that they are close to completion on their airplanes. Knowing many of the orders were from builders who were far from being finished and requiring a prop, we bypassed these in order to get the builders flying that had completed airplanes. Consequently, many of you that ordered a long time ago have not received your props or heard from us lately. We definitely felt an explanation was due all of you and wanted to let you know what is happening. Therefore, we would like to ask you to call or drop us a note when you feel you are getting close to completion so that we can get your prop ready. We apologize for any inconvenience and appreciate greatly the cooperation and understanding all of you have extended to us. Beginning in January, we will be making the props on a full-time

basis and should be able to get caught up on our back log in addition to getting back to a decent delivery schedule. Thanks again!
Bruce and Bonnie Tifft"

CP38, Page 9

The following is a letter from Ken Swain on his incident at Oshkosh, 1983. We have printed the letter in its entirety as maybe it will help someone in a similar situation one day.

"On August 2, 1983 my VariEze N4ZZ suffered a total power loss over Lake Winnebago and was substantially damaged in the ensuing off airport landing. Since it happened at the EAA Convention, there were a lot of stories that were semi-correct floating about. I would like to give the complete one to C.P. for dissemination along with my personal analysis of the apparent causes. Also, while I in no way consider myself the world's most experienced pilot, I do believe that my recurrent emergency training as an active duty, current Air Force pilot gives me a perspective on emergencies not held by the average private sportsman pilot. Hopefully some of the low time EZ drivers can get some food for thought from my actions.

THE FACTS: The flight before the ill fated one was the Oshkosh 500. During the race I noticed that the fuel flow would occasionally drift up from the set 6.4 gph to 9.5 gph. Since additional leaning had no effect I concluded that my Compucruise had swallowed a few bad electrons and would have to be looked at after the Convention. Each drift up episode lasted only 15-20 seconds. I completed the race, bought 9.5 gallons of gas, and 2 hours later took off in a flight of 10 race aircraft to return to the Convention as the beginning of the pre-airshow. We were on downwind, over land, within landing distance of the field when we were sent to a VFR holding pattern over Lake Winnebago. five to ten minutes later we were cleared for approach and we headed for the field. I soon reduced power to idle to slow to gear lowering speed, got the gear down, then left power back until I hit pattern speed. When I advanced the throttle there was no response. Tach showed windmilling RPM and all temperatures and pressures were in the green. My position was approximately 1 1/2 to 2 miles from shore over the lake at 100 ft agl at 100 mph. I immediately initiated a turn towards the closest land while switching to the header tank. I then raised the gear and slowed to best glide for my aircraft. While cycling mags, mixture, and throttle I made my first of two terse unanswered radio calls: "4ZZ has lost power over the lake and is attempting to reach the shoreline just south of Oshkosh". By this time I was 1 mile from shore and the prop had stopped. A cornfield was the only area that wasn't wet, hard (trees, houses, wires) or full of people that was clearly within my small energy envelope. I kept my eyes on it while I made my last airborne call: "Hey people, listen up. 4ZZ has lost power over the lake and is headed for the shoreline just south of Oshkosh". There was a strip of grass running through the field so I decided to try for it. I cleared the 75 ft. tall trees at the shoreline by about 20 feet, lowered my gear again and made a left turn to line up with the length of the cornfield. Just prior to touchdown I slowed to between 50 and 55 mph indicated, a speed I have often flown during flight tests. As I touched down it turned out the ground beneath the grass was not level and the grass to my left was

taller. The left main then failed torsionally, pulling the nose left, causing the aircraft to enter the corn. The nose was now pointing 45 degrees to the left of the motion vector. The aircraft wound up on the nose and right main gear. The momentum continued the rollover on the right canard tip and wing tip. The canopy shattered as I hit the ground inverted. The aircraft came to rest on the rollover structure and the remains of the rudder tips. The nose of the aircraft was pointing 90 degrees to the left of the direction of landing. I was about 100-150 yards from the lake, hanging in the straps, trapped in the wreck. I dug my head set out of the dirt where the front of the cockpit used to be and got off one call to Johnny Murphy who was circling overhead, to let him know I was ok. Then I smelled gas so I shut off the master.

AIRCRAFT DAMAGE: Besides the rudders and canopy, the main gear strut is failed torsionally on the left and right sides. The right gear attach is 100 percent intact. The left tabs and attach are intact but the pad layup has separated from the strut on the front half. The motor mount failed in tension at the first welds at each bottom corner; the aluminum extrusions are intact. Wings are intact. The right strake tank is separated from the spar all the way around and leaking freely. The left tank appears to have held, with minor fill cracks. Compression damage done to the inboard rib of the right aileron by the cowling are intact. Seat belts and attach are 100 percent intact. The forward fuselage sides and top will have to be completely rebuilt from just in front of the instrument panel forward. Nose gear, strut and box are intact. F28 is broken in two places. F22 broke in 6 places. The top right longeron is crushed. The canard lift tabs are twisted and the outer left of the right tip will have to be replaced. The possibility of damage exists in the canard center spar but I have yet to strip the cover off the canard center to inspect it.

POST CRASH INVESTIGATION: When the wreck was pulled off the trailer used to get it back from the cornfield, the engine started on the forth blade and ran strong. After shutdown a small but steady stream of fuel ran from the carburetor. Tapping on the bowl eventually made it stop. Later, with representatives of both the FAA and NTSB present, the fuel system and carburetor were disassembled and inspected. There was some sand in the VA-6 fuel filter. There were a few infinitesimal slivers of teflon tape and a small amount of fine sand in the carburetor bowl. Less than 200 gallons of gas had been run through the system since cleaning at annual on June 30. The needle valve was clean and free and the float was undamaged. There was extensive fuel staining of my brand new ram air elbow.

MY ANALYSIS OF THE CAUSE: First, I totally rule out carb ice. I have 800 hours experience with my Lycoming and have only had it ice a couple of times in the most severe carb ice conditions. What I believe happened was this: One of the four FBO's that I bought fuel from after my annual passed some sand along with the fuel. Some of that sand eventually made it through the filter and was intermittently preventing my needle valve from closing completely. The teflon tape shreds could also have done it but there were only 3 of them and there were lots of grains of sand, 300 to 400 grains. Under pressure from the fuel pump the bowl would then overflow out the atmospheric vent, into the elbow. I believe the high fuel flows I noted during the race were grains of sand in the process of passing the needle valve. Since the power

setting was high, the engine just ran a bit rich for a short while. The worst case would be to experience a needle valve clog at the moment of quickly reducing power to idle. The engine would then flood since fuel pump out put is proportional to prop rpm, not power demand. It would be so loaded up that it could take quite a while to clear, certainly more than the 15-20 seconds of windmilling prop time that I had.

Other support for this view: The stream of gas from the carb after shutdown and the fuel stains on the elbow where 2 hours earlier there were none. Also, at the completion of the Oshkosh 500, Gene Sheehan looked at my exhaust stacks and commented on how lean I must have been running the race since they were almost white on the inside. After the crash and at most 10 to 15 minutes of flight, they were heavily caked with black soot.

MY ANALYSIS OF MY INFLIGHT ACTIONS: In retrospect, I feel I did a few things wrong and a bunch of things right handling the inflight portion of my emergency. My biggest mistake was not turning off the master before impact. I should have. My biggest correct action was not even a conscience one. Both the military and FAA part 121 operations require seat belts and shoulder harness to be worn by flight crew for all takeoffs and landings. My habit is to always keep them both on. I loosen, but never remove, the harness only once in a great while at high altitude cruise. Had I not had a tight seat belt and shoulder harness, I would be dead! Instead I walked away from a pretty spectacular crash literally without a scratch.

Other "right actions": My immediate turn towards shore at the first hint of trouble. 2. My immediate raising of the gear. 3. My immediate switch to the header tank which, 4. allowed the rapid, and correct, decision that the engine wasn't coming back; this prevented me from wasting precious energy/altitude on keeping the prop windmilling. 5. My rapid attaining of best glide speed for my airplane as determined by flight test. 6. I picked out the only field that I was certain I could make and never let it out of my sight. Remember, I cleared the trees by only 20 feet from almost 2 miles away. Had I omitted any one of the above actions, I probably would have hit the trees or lake. Cornfields are rough on airplanes, but not nearly as rough as trees or water at high speed.

Some additional right actions: I devoted my full attention toward stabilizing the situation before giving any thought to a radio call. I also got the aircraft as slow as I had been able to demonstrate good control in flight test before touchdown. Another very important action was the relowering of the nose gear before touch down. Judging from the damage to the gear doors and paint abrasion on the strut, grass drag (=slow down help) on the strut was significant. Had it not been down, I probably would have gone over at 50 mph vs. 20 mph.

My last correct decision was to leave my seat belt buckled when the 160 lb. fireman said "OK, unbuckle the belt". About 15 people had lifted the airplane, still inverted, about 5 feet off the ground. I said to him, "Are you ready to have 215 lb. come tumbling down on your head as soon as I open it?" He said, "Wait a minute", and got another fireman to help. I could just see me surviving the crash unscathed only to break my neck in the rescue!

SOME FINAL THOUGHTS: Thanks Burt, for designing a super strong airframe and especially a super strong rollover structure. Without it I would have been severely injured or worse. The TV newsman asked if I was scared. I told him that I was too busy doing my job, flying the airplane, to be scared. Every military flight manual I've ever used has virtually the same basic instructions for handling any emergency:

1. Maintain aircraft control
2. Analyze the situation
3. Take corrective action.

Nowhere does it say to wring your hands, go berserk yelling for help in the radio, or to contemplate your navel. The only person who can help you out of your hard spot is you, and you won't be any good whatsoever to you if you don't keep a calm, clear mind and concentrate on the business at hand.

Ken Swain"

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Twins! Co-winners of the Designers Award at Oshkosh, 1983. Don Prestin and Don Shaw, both of Santa Rosa, CA. Congratulations!

Herb Sanders shows what can be put on a Long-EZ panel. 1 1/2" instruments are: EGT, oil pressure, tachometer, CHT, oil temp, manifold pressure, fuel pressure, OAT. Transponder is an RT887 and Nav Comm is an RT 563A. Herb sells these miniature engine instruments by B & D.

Stig Sall, proud owner/builder of the first Long-EZ to fly in Sweden.

VariViggen. Frank Stites has it ready to take to the airport. Looks great!

Newest VariEze to fly, Jimmy Cox, Fort Smith, Arkansas.

Don Foreman's beautiful Long-EZ ready to go to the airport. This is the first Long to fly in England and it has a Rolls Royce O-240, 130 hp engine!

Now this is going too far! Steve Palun, Amherst, OH. Wonder what he is building?

The Wayne Woolway family in the now classic pose, first flight around the yard. Good looking workmanship.

DEFIANT
HOMEBUILT
FOUR-PLACE
TWIN

Canard Pushers from 1 to 82

Introduction
For some time you have been reading about the four place, push pull twin engine Defiant. After five years of enjoying a "one of a kind" aircraft, Burt Rutan has made the decision to release Defiant drawings to the homebuilder. In late 1981 Burt contacted Fred Keller of Anchorage, Alaska and asked if Fred would be interested in building a Defiant and keeping a complete log with updated drawings and photographs as he was building. Fred agreed and at the EAA convention in Oshkosh 1983, Fred's Defiant was on display. Some changes have been made to the original aircraft such as, an increase in span on both main wings and canard and a revised aileron for lighter control forces. The back seat folds forward for a `station wagon' effect that allows two people to use the baggage area for sleeping. The canopy opening has been improved for easier entry. The fuselage has been changed to allow more head room for the back seat passengers.

Fred Keller is now completing the detailed plans for the Defiant. These will be available from RAF in March 1984. The builder support will be from Fred for plans interpretation, and from RAF for general `how to' on the construction.

Description
The Defiant is a four place, canard-type twin with two 4 cylinder Lycoming engines. Engine power can be 150, 160 or 180 horsepower per engine. It's canard configuration provides several important benefits as compared to conventional twins; (1) Packaging is considerably more efficient - it has a standard-size cabin in an airframe whose whetted area is only 60% that of a conventional light twin. (2) The smaller airframe also has reduced structural load paths allowing a structure much lighter than a conventional twin while having better durability and a higher `g' capability. (3) The tandem wings allow natural aerodynamic angle-of-attack limiting, thus, the airplane is stall resistant. (4) The tandem wings, using winglets for directional stability provide a 30% reduction in induced drag compared to a conventional aircraft with the same span loading. (5) Flight control systems are simpler and lighter. Elevators are only two feet from the control sticks and they provide a flap effect without having separate flaps, thus, at low speed the canard has a deflected full span slotted flap, yet the pilot has no flap control to adjust.

The rudder is only one foot from the pilot's rudder pedals. It is designed to provide control, yet have no effect on stability. Ailerons on the aft wing are controlled from their inboard end such that the entire wing and vertical fin assembly is built without any moving parts.

The small chord elevators and ailerons allow control forces compatible with a side-arm control stick. This allows more precise, less fatiguing control and provides improved use of primary instrument panel space.

Instead of the complex electrical system with one buss and battery tied to two alternators, the Defiant has two simple separate electrical systems, each with its own battery and alternator. IFR avionics are split to both systems so that no single failure can effect essential equipment. Both engines can be started simultaneously. The two systems can be tied together to run all equipment from one alternator

in the event of a failure. Also, a low battery can be charged by the other engine without ground electrical equipment. Thus, the electricals are much like conventional fuel systems, i.e., completely independent but with "crossfeed" available in an emergency.

The fuel system consists of a 58-gallon tank with a large sump for each engine. The two systems are independent and require no pilot action for normal operations. Crossfeed is available. The sumps are accurately gauged and are equipped with low level warnings, such that when 45 minutes fuel remain the pilot not only has a warning light, but has a gauge that moves full scale for the last 45 minutes fuel. He can then intelligently plan his options when fuel is low, knowing quantity to within 1/3 gallon of fuel. The last one half gallon of fuel can be used in all normal attitudes. While appearing small outside, the Defiant is quite roomy inside. It has a cockpit width at the elbows of 46 inches (43 inches at rear seats). Knee and leg room for the backseats is a full eight inches more than current light twins. The Defiant has a large baggage area aft of the back seat and even larger if the back seat is layed flat. Two six foot people could use this area to sleep in. The unique semi-supine seats provide a significant advantage in comfort over conventional seats. With a conventional seat, the upright pilot carries all his weight on the buttocks and small portion of the thigh. The Defiant's seat is reclined a full seven degrees more and armrests and headrests are provided for all seats. Thus the body weight is distributed over the lumbar, forearms, thighs and head, rather than being concentrated in the tailbone area. In general, a person who normally finds himself fatigued after a two to three hour flight, will be comfortable even twice that long in a well supported reclining seat.

The side arm controller and throttle system places the pilot's arm in a more natural position while flying and frees his lap area so he can use an airline type lunch tray for maps, approach plates, computers or lunch. Space efficiency and panel visibility is considerably increased when the control wheels are eliminated.

The aircraft is very basic in its systems. It will never require maintenance nor have an AD issued on its flaps, retractable main gear, cowl flaps, governors, hydraulic system, oleos, stall warning, nor emergency gear extension system, since these were eliminated in the basic design. The remaining systems (flight controls, power plant installation, electrical system, fuel system, etc) are all very basic and simple compared to the conventional light twin. This saves weight, reduces maintenance and increases availability and reliability.

Visibility, particularly in the pattern, is superior to current light twins. The canard wing is at approximately the same height as the nacelles on a Seneca II. Forward downward visibility is adequate over the canard during normal climb, approach and landing flare. Absence of a wing above or below the cockpit area results in a welcome improvement in visibility over conventional aircraft.

Flying Qualities
Flying qualities are conventional with the following exceptions: (1) Spiral stability is positive and speed stability is high, such that the aircraft flies "hands off" indefinitely once trimmed, even in turbulence. (2) There are no pitch or roll trim changes due to

configuration or power. Once trimmed at approach speed it will hold that speed hands off during power changes and landing gear extension. The airplane is very stiff in yaw with high damping. Yaw oscillations damp in one to two cycles after a side slip release, as compared to three to six cycles for a conventional light twin. Roll rate is excellent. Adverse yaw is low enough that all normal maneuvering can be done with "feet-off-pedals" resulting in less than one-half-ball yaw excursions.

The Defiant is a very stable IFR platform with a very solid "big airplane" feel. It holds a desired approach speed with less attention than a conventional light twin.

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Performance

In general, simplified systems means reduced performance. Not true for the Defiant. Overall performance and efficiency is significantly better than conventional light twins. Data discussed below are for 160 BHP engines. Time-to-climb to 12,000 feet is 10.3 minutes with full fuel and four adults and 7.7 minutes with two adults and 400 nm fuel. At maximum cruise speed of 184 knots (75% power), total fuel flow is only 17.8 gal/hr giving a 1.74 nm/lb economy and a range of 1044 nm with reserves. At 55% power (168 knots) total fuel flow is 13.9 gal/hr giving 2.00 nm/lb economy and a range of 1208 nm with reserves. At low cruise (40% power, 150 knots) range can be stretched to over 1300 nm with reserves. At equal loading and speeds, Defiant gets over 50% more miles per gallon than a conventional light twin! Holding capability is also impressive. At medium weight Defiant can remain aloft on only 40 thrust horse power (64 brake hp) for a maximum endurance of over 14 hours. The excellent two-engine climb capability allows cruise altitudes as high as 18,000 feet with 4 adults and full fuel. The prototype has climbed above 28,000 feet at light weight, single place. This climb capability is far in excess of similarly equipped light aircraft. (Fixed pitch prop and no turbocharger).

Single Engine Capability

In contrast to all other light twins, in which after engine failure a many-step procedure must be accurately followed during which aircraft control and airspeed control are critical, the Defiant makes no demands on the pilot to follow procedures. He can even use any excess airspeed over the minimum full-aft-stick speed to zoom over an obstacle. Once over the obstacle he can maintain aft stick and climb away (single engine) or accelerate without altitude loss to best climb speed. This unique capability is best shown by comparing the Defiant's takeoff profile with that of a conventional light twin (figure I). Both airplanes are at maximum gross weight. Both aircraft experience failure of the critical engine at 10 foot height. Neither aircraft can land and stop in the remaining runway, so they must continue the take off. The conventional twin pilot must immediately do the following: (1) raise gear (2) identify failed engine (3) retard throttle on failed engine (4) cutoff mixture on failed engine, (5) feather failed engine, (6) bank five degrees toward operative engine, (7) carefully raise flaps, (8) Maintain 82 KIAS to 50 foot altitude. After 50 feet (accel-go procedure) he accels to best angle of climb speed (95 knots) and thus, does the best he can do to clear any obstacles. Height-distance

profile for this is shown as the lower line in Figure I. Note that even though his eventual climb gradient is adequate (193 feet per nautical mile) the 310 is nearly 4500 feet from brake release before reaching the 50 foot height, and that unless airspeed control and procedures are accurate he will likely crash during this climb segment.

The 310 is one of the best light twins to perform this profile. The "light-light" twin types will either have less performance or will strike the ground during segment A.

The other lines on Figure 1 represent the performance obtained by the Defiant for several conditions. The lower lines are obtained if the pilot elects to fly at the best single engine rate-of-climb speed. Note that if the pilot does nothing but maintain airspeed he will clear the 50-ft obstacle at 3300 feet, even with the gear down.

FIGURE 1 OMITTED

The upper lines on Figure 1 indicate an even more interesting capability of the Defiant. Suppose a tall obstacle exists at the end of the runway. The Defiant pilot can pull back the stick to zoom over the obstacle, even slowing to his minimum speed of 65 knots. After clearing the obstacle he can merely hold the stick aft and safely climb away even if he leaves the gear down (no procedure). If any conventional light twin attempts this, an accident will result, since, they cannot climb when near min control speed or stall speed. If desired, a standard rate turn can be initiated following an engine failure during lift off at gross weight.

Specifications and Performance
(with 160 BHP engines, fixed Props).

Engines (2)	Lycoming 0-320
Seats	4
Basic Empty Weight	1600 lb.
Equipped Empty Weight	1680 lb.
Equipped useful Load	1270 lb.
Gross Weight	2950 lb.
Fuel Capacity	115 gallons
Span	31.4 feet
Wing Area	133 square feet
Wing Loading	22.2 lb/square feet
Power Loading	9.2 lbs/hp
Payload with full fuel	660 lbs.
Max Cruise (70%)	184 knots
Fuel flow at max cruise	17.8 gph.
Range at max cruise (45 min reserve)	1044 nm
Economy Cruise (55%)	168 knots
Fuel flow at economy cruise	13.9 gph.
Range at economy cruise (45 min reserve)	1208 nm
Climb Rate (2950 lbs)	1500 fpm
Climb Rate (2220 lbs)	1900 fpm
Single Engine climb (2950 lb)	310 fpm
Single engine service ceiling (2950 lb)	6500 ft.
Single Engine Climb (2200 lb)	550 fpm
Stall Speed (2950 lb)	64 knots
Stall Speed (2200 lb)	58 knots

Cost and Time to Build the Defiant
The cost of the materials list has not been completed at this time, but we estimate the cost of building the Defiant will be approximately "two Long-EZs", between $20,000 and $30,000. Remember that avionics can cost you as little as $1000 or as much as you wish to pay.

Time to build the Defiant, again will be "two Long-EZs" as it is the same type of construction, just more. A competent builder can build a Defiant in as little as 2000 man hours. Until the plans are completed, it is difficult to say how many of the parts will be available prefabricated and this would make a difference to the time to build.

	U.S.A.	Overseas
Canard Pusher Newsletter	$ 6.75	$ 8.75
Defiant Plans - Section I	$490.00	$510.00
Defiant Engine Installation	not available at this time.	
Defiant Owners Manual	not available at this time.	

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SOLITAIRE -
A
Self-Launching
Sailplane

THE PROBLEM
For a long time soaring has been an exclusive sport requiring a special license and training. Soaring in a glider of enough performance to allow the average pilot to feel the true thrill of 'engineless' flight has been expensive enough to severely limit the number of people who enter the sport. The current interest in ultralight and light sport aircraft has reached an all-time high.

THE CHALLENGE
The Soaring Society of America recognized the problem. Other segments of homebuilt aircraft were experiencing great interest and activity on the part of designers and the general public. The sailplane market was not getting its share of the attention. To correct this, the SSA issued a challenge in the form of a contest. Develop a self-launching sailplane capable of take off and the ability to climb to altitude without the use of a tow plane. The new design could be flown without the special license required of a sailplane pilot, just a private pilot's license. The aircraft must be easy to fly, as well as quick and easy to build. Strict rules were set up and an actual structural test of the finished aircraft was required. The Solitaire was designed around these goals and achieved these and more.

THE WINNER

At the flyoff held in Tehachapi, California, on September 6, 1982, the judges studied the entries, flew the SOLITAIRE and unanimously declared it the winner.

WHAT
The SOLITAIRE is a single-place self-launching sailplane that is fitted with an engine package that folds into the nose of the aircraft after it pulls the SOLITAIRE to soaring altitude. With the engine folded, it has a L/D of 32 to 1 giving it true soaring capability. The engine can be deployed and restarted inflight using its electric starter. The canard concept results in high resistance to inadvertent stalls and spins. Its 'spoilflap' descent control system has been acclaimed as "excellent" by all evaluators, providing crisp, variable glide path control without trim upsets. Unlike conventional sailplanes the pilot sits within the allowable cg range.

HOW
The SOLITAIRE uses the proven materials and methods pioneered by Burt Rutan and used in the VariEze and Long-EZ, two of the most successful aircraft ever designed for the homebuilder. The wings are special uni-directional fiberglass cloth and epoxy resin. They are built using the moldless composite technique developed in the VariEze and consist of prefabricated 'S' glass spars and a solid foam wing core. The fuselage comes as two prefabricated halves. The bulkheads are available prefab and the wooden fixtures and templates will be available premanufactured. The canopy comes installed in the frame and the turtle deck is available prefabricated. All of the metal parts and complete landing gear components are available premachined. The premolded parts are of aerospace quality. Construction consists of prepreg skins with a honeycomb core and an adhesive film to bond them together. These are then vacuum bagged and cured in an oven. In short, this aircraft will have more prefabricated parts than any previous design from Rutan Aircraft Factory. Of the available prefabricated parts, the builder can buy all or as few parts as he wishes. We estimate that an average builder, purchasing all the available parts could build the aircraft in 400 hours at a cost of between $7000 and $9000. When the quality of parts and the ease of building is considered the value of the SOLITAIRE becomes apparent.

SUPPORT
Rutan Aircraft Factory support has been a key factor in the history of success with homebuilt aircraft. When you buy plans, you become one of a family of builders. Rutan Aircraft prides itself on its builder support program. We will answer questions either by phone or in writing. Builders are also welcome to bring parts to Mojave for inspections and advice. The quarterly newsletter is mandatory when you are building, as it provides continuing builder hints, ideas and plan updates.

ALL RAW MATERIALS.

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow, Box 424,
Fullerton, CA 92632
(619) 870-7551
Catalog $4

Near St. Louis.
WICKS AIRCRAFT
410 Pine Street,
Highland, IL 62249
(618) 654-7447
Catalog $3

ALL PREFAB MACHINE PARTS.

KEN BROCK MANUFACTURING
11852 Western Ave., Stanton, CA 90680
(714) 898-4366
Catalog $3

PREFAB FUSELAGE, CANOPY, TURTLE DECK, WING SPARS, SEAT PAN.
TASK RESEARCH
848 East Santa Maria, Santa Paula, CA 93060
(805) 525-4545

SPECIFICATIONS
SOLITAIRE - RAF Model 77-6

Empty Weight ..... 380 lbs.
Gross Weight ..... 620 lbs.
Total Wing Area ..... 102.44 square ft.
Span ..... 41.75 ft.
Wing Loading ..... 6.05 lbs./square ft
Engine ..... KFM 107E
BHP ..... 23 at 6000 RPM

Fuel ..... 5 gal. premixed @ 40:1
L/D ..... 32/1 at 50 knots
Min. Sink ..... 150 ft./mn @ 40 knots (approx.)
Descent Control ..... Spoilflaps usable to Vne
Min. Flying Speed ..... 32 knots
Vne ..... 115 knots
CG ..... unaffected by pilot weight

SOLITAIRE DOCUMENTATION
Canard Pusher Newsletter published quarterly.
One year's subscription $6.75

Section I - Manufacturing Manual $225.00
This is the complete education and construction manual for building the entire SOLITAIRE except for the engine installation. This manual consists of a spiral book 11" x 17" together with a set of 23" x 33" drawings, which include all necessary full-size templates, jigs and cross sections.

LONG-EZ
FAST
EFFICIENT
HIGH UTILITY
LONG RANGE

THE AIRPLANE
The Long-EZ is a small, high-performance, high utility homebuilt sportplane. While recommended mainly for day-VFR operation, competent pilots can also equip it for night and IFR flying. The recommended

power plant is any model of the 0-235 Lycoming. Note that a mechanical fuel pump is required. It has an alternator-powered electrical system and can be equipped with electric engine starter. Its cockpit layout is designed to complement pilot work load, with throttle, mixture, carb heat, pitch trim and landing brake controls on the left console and side-stick controller on the right console. Seating provides correct armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portion of the large wingstrakes are used as baggage areas, accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

The airframe structure is a sandwich of high-strength fiberglass facings with a core of rigid closed cell foam. Extensive use is made of the new type R45 PV core foam (poly vinyl). The facings are laid up directly over the shaped core, thus expensive tooling is not required. Flying surfaces are full-core, reducing complexity, increasing contour stability, and improving corrosion resistance. As compared to conventional metal and wood, composite sandwich structure offers less construction time, more uniform stresses, improved fatigue life, better environmental resistance, and increased surface durability.

TRAVELING MACHINE

At last, an airplane that is specifically developed for efficient, high speed, long range traveling with room for two adults and plenty of baggage. Fuel allowance with two adults is 41 gallons. Single place, you can carry 52 gallons. If you're in a hurry, you can cruise at 75% power at 8000 feet at 189 mph (164 kts) burning 6.6 gallons per hour. This will take two of you from Los Angeles to Seattle or Chicago to Daytona Beach non-stop (965 miles) in 5.1 hours with one hour fuel reserve. If you're not in a hurry, you can cruise "economy" at 12,000 feet at 146 mph (127 kts), burning only 3.6 gallons per hour. This will take two of you from New York to Dallas non-stop (1430 miles) in 9.8 hours with a 1.5 hour fuel reserve. Single place, using the entire 52 gallon fuel capacity, stretches the maximum range and endurance to over 2400 miles and 23 hours!!

UNUSUAL EFFICIENCY

The Long-EZ uses the very latest aerodynamic technology, combining winglets, a high aspect-ratio wing with Eppler airfoils optimized for efficient cruise, and a configuration with far less wetted area than conventional airplanes. As a demonstration of its efficiency, our prototype with a large rear-seat fuel tank flew over 4800 miles, setting a world's distance record, and landing with enough fuel to surpass 5000 miles. At that, its capability was not taxed - its initial climb rate was over 600 ft/mn! At light weight, it climbed to 27,000 ft. in still air - an altitude unheard of, for a fixed-pitch, non-turbocharged airplane. Our Long-EZ is so efficient, the engine can be shut down while at 5 foot altitude over the numbers at only 120 knots, then it can pull up, fly a 360 degree pattern and land on the same runway - completely without power! Its power-off glide angle is only 3.7 degrees - thus a belly mounted drag device (landing brake) is used for landings.

SUPERB FLYING QUALITIES

Development of the Long-EZ included flight testing of many refinements to optimize flying qualities. It is a very solid, stable airplane that has responsive ailerons, good turbulence response, excellent "hands-off" stability and docile stall characteristics. It resists stall or spin even when maneuvered sharply to full aft stick. Flight tests show the prototype to be free from stall departures and spins for all type of entries, including tailslides. Climb is excellent, even at the full-aft-stick speed. Trim changes due to power, gear retraction or landing brake are all very small. Its wide cg range allows a large range of pilots or passengers weighing up to 250 lbs.

The Long-EZ's approach and landing speed are 75 mph (65 kts) and 60 mph (52 kts) at normal landing weights. The approach and landing are docile and conventional. Forward visibility is excellent even during a "full stall" touchdown - a considerable improvement over our earlier VariEze.

PHOTOS OMITTED

THE HOMEBUILDER SUPPORT
The plans are a literal education in using the materials and is a detailed step-by-step guide to construction using an illustrated format not common in aircraft plans. The Rutan newsletter, the "Canard Pusher" published since 1974, updates plans, provides building hints, etc. Complete Owners Manual provides all necessary information for initial testing and for normal emergency operations. You may call, write or bring parts in for inspection at any time.

THE TEST PROGRAM
The test program was probably the most extensive and successful ever conducted on a homebuilt. It included basic flight tests for flying qualities, performance and systems, spin and dive test to FAR Part 23 requirements, static load test and landing gear drop test exceeding Part 23 criteria, environmental/thermal tests on structural materials/components, manufacturing methods testing and many others.

COST AND BUILDING TIME
The complete package of raw materials available from the two distributors listed, including all fiberglass, epoxies, foams, fillers, sheet metal, tubing, hardware, controls system materials, plumbing, tires, wheels and brakes cost about $3600. Any of these items can be purchased separately. We strongly recommend that you get the distributors' catalogs to familiarize yourself with the materials. A complete bill-of-materials is in the plans.

Many other prefab parts ranging from main gear, nose gear, propellers, cowlings, canopies and welded engine mounts to small aluminum brackets and bushings can be purchased from the listed distributors. All those prefab parts cost approximately $3000 - and using them, the competent builder can build a Long-EZ in as little as 1000 man-hours. The budget-minded builder may elect to build most of these prefab parts himself, using the drawings in the plans. His building time would exceed 1500 hours and he would save most of the above costs of the prefab items. Contact the distributors for their catalogs showing available prefab parts. These are also listed in the plans bill-of-materials.

Engine costs vary widely. Our prototype has an 0-235 Lycoming, that had 1400 hours when purchased, for $1,500. It has 600 hours to overhaul and will be worth then, about what we paid, thus this is a very economical way to go. Newly overhauled or new engines can cost from $3000 to $6000. Engine accessories, such as instruments, prop extensions, etc. cost about $500 to $700.

In summary the total cost can run from $6000 for a basic airplane with a 3/4 runout engine and owner-built prefab parts, to $14,000 for everything available purchased and a zero time engine. IFR avionics can add from $2,000 to $15,000 to those numbers, with many options available.

**PHOTO OF STARSHIP OMITTED*

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 39. If you are building from 2nd Edition plans you must have newsletters 18 through 39. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 39. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 39. If you are building a Long-EZ you must have newsletters from 24 through 39. If you are building a Solitaire, you must have newsletters from 37 through 39.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
We have been kept quite busy supporting VariEze, Long-EZ and Solitaire builders. In addition work continues on Voyager project. Although this airplane is being built in RAF's skunk works, information on it is very limited as the program is proprietary to Dick and Jeana. We have also developed, installed and flight tested, larger more powerful rudders on the prototype Long-EZ, N79RA as well as on Mike's N26MS.

DEFIANT

Fred Keller is working like a little Alaskan demon on the plans. He has brought them down to RAF so we can spend several weeks to verify them and get them ready for the printer. We are still shooting for March for plans availability.

NEW RUDDERS FOR LONG-EZ

For almost two years we have worked hard on nosewheel steering for the Long-EZ. The reason we did was the Long-EZ's one weakness, a take-off on a narrow or icy runway with a strong cross wind. Due to the requirement to brake for steering on the ground, the take-off roll with a stiff cross wind is extended. We wanted to eliminate this problem, and some form of nose wheel steering seemed like the logical way to do it. We spent many frustrating hours, and actually installed several different types of nosewheel steering mechanisms. None of them proved to be effective enough and it soon became clear that the only way to achieve this was to completely redesign the nose gear. This got away from our goal of a simple, retrofittable system.

Some time ago Charlie Gray of Lantana, Florida had asked our advice on larger rudders for his modified Long-EZ. We saw his airplane at Oshkosh with Mike and Dick both having the opportunity to fly it. Both were quite impressed with the effectiveness of the larger rudders, particularly the way they "steered" on the ground, even down to quite low airspeeds. Dick installed his own version of the larger rudders on his and Jeana's Long and Mike had the opportunity to evaluate their effectiveness in a 20 knot plus cross wind, on a narrow runway.

Now all we had to do was convince Burt to let us try it on N79RA. He gave us his blessing and the two Michaels and Sally cut out the old rudders, foamed and glassed the winglets, cut out the new ones, glassed them, hinged them and had them ready to fly (minus finish paint) in only 3 days. (These were not 8 hour days!!!). They also photo documented the whole procedure.

Mike put on the trusty parachute and climbed to 12,000 feet where he put old 79RA through a vigorous test program to determine departure susceptibility similar to the one that Phil Brown of NASA did several years ago. The result was very satisfying. The prototype N79RA, even at the aft limit of the cg envelope (103") will not depart or do anything unusual, even using aggravated control inputs at all attitudes and airspeeds from full aft stick (52 KIAS) to the maneuvering speed (120 KIAS) including full pro-spin controls in both directions. Mike has demonstrated crosswind take offs and landings in direct crosswinds of over 20 knots. We are very pleased with the performance of the new rudders and feel that they are a very real and desirable improvement to the Long-EZ. We do not intend to make their installation a mandatory one. However we believe that the original rudders, while not super, are adequate, and any Long-EZ flyer who is satisfied with his or her yaw control does not need to install the new rudders.

For those builders wishing to have more yaw authority, better crosswind take off and landing capability and less braking required for steering on the ground (at least while taxiing into the wind!). We have a set of plans available for $18.50. These plans consist of 4 pages 18" x 24" with a detailed description as well as many cross section drawings and sketches. Two of the pages have a total of 28 photos of a step by step sequence of how to retrofit these rudders to your already

completed Long. The plans also cover installation on a new construction Long-EZ. The plans are available off the shelf as of now.

We sincerely hope that the builders and flyers out there in the field appreciate the amount of time, effort and not a little risk that RAF puts out for continued support and improvement where possible for the RAF airplanes. You can demonstrate your support by paying for one set of plans for each airplane you build. Those builders out there that are building more than one airplane from one set of plans, are not just cheating RAF, they are actually cheating themselves and may eventually end up cheating all of our builders RAF has the finest builder support program in the industry and we are very proud of that. We intend to continue with the same quality program for the foreseeable future. However, we do need your support to do so. A very high percentage of our builders do support us and have rigidly stuck to the license agreement of one plane per set of plans. We sincerely appreciate your honesty and your support. Those who have not supported us, stop for a moment and consider what a small percentage of your airplane's total cost your plans are. Consider also what you get for that cost. Not only an excellent flying machine, but the designing, structural testing, flight testing and development of that flying machine. Add to that the fact that we are here 6 days a week, ready to help you on the phone or by mail, any time you don't understand something, or have got yourself into a jam. Actually the plans are quite a bargain if you think about it. Enough said!

EZ FLYINS

Shirl Dickey of Salt Lake, Utah once again is organizing the Jackpot Flyin. The dates will be 6, 7 and 8 July 1984. The race will be held again this year but with different class categories, with $800.00 in prize money so far. There will be a banquet Saturday night, with spot landing and ribbon cutting etc. during the day. More news to come in the next CP. Contact Shirl at 1646 Allegheny, Murray, UT 84107.

NEW DEVELOPMENTS

Since January 1982, RAF has been working on a new canard airfoil for the Long-EZ. The design goal was higher performance, lower takeoff speed, lower landing speed, and no rain trim change. Quite an order. John Roncz, (designer of the Solitaire airfoils) said he could do it, so we asked him to have a shot at it.

The canard was built and test flown in early 1982, and even flown in the CAFE 400. It had some problems and needed more refinement. We have been working on it and flying it on and off since then, with mixed results. Some aspects are excellent, others are not good. We are actively pursuing this test and if we get it to where it meets our requirements, we will publish the results and put out plans for the canard as an optional performance change.

Please do not call us for information on this canard. We cannot release any data on it until it meets the standards we require. The only reason we are reporting on it at this time, it that so many builders have seen it on the Long-EZ here at RAF, that rumors are flying around. RAF's policy is that we will not put out any

information on any design modifications until we are completely satisfied with the results of flight testing. At this point, we are not satisfied, but are continuing with flight tests. Stay tuned.

1/5 SCALE LONG-EZ R/C MODEL
In December, 1983 RAF granted St. Croix of Park Falls, Ltd. the exclusive rights to develop and market a radio controlled scale model of the Long-EZ. On December 13, Jim Schmidt, Manager of St. Croix's Model Aircraft Division, flew prototype demonstration flights at the Mojave airport for Mike Melvill who agreed that the model looks and performs much like the real thing.

The kit, which will build up to a 1/5 scale replica of Mike and Sally's Long-EZ will be available in the spring and should retail for under $100.00

To receive information about this product as it becomes available, you may contact Jim at the following address:

Jim Schmidt,
St. Croix of Park Falls Ltd.
P.O. Box 279E,
Park Falls, WI 54552

The 1/5 stand off scale model Long-EZ was painted to look exactly like N79RA and when it was in the air, it looked for all the world like the real thing. It flew very well, Jim really knows how to fly R/C models. Mike had not flown an R/C model in two years but Jim allowed him a few minutes of "stick time" and Mike said it was a 'blast'!! It flew just like the real one, right down to the full aft stick, no stall condition, it even rolls much like a real Long. To watch it come in and land was quite a treat. Mike was able to take Jim for a ride in his Long-EZ and although Jim had never flown a light plane before, he was quite at home in it and commented that it was just a big model!!

As soon as St. Croix has the kit available, RAF plans to keep some in stock.

NEW EZ FUEL GAUGE
Paul Prout has been working for almost a year on a fuel gauge for VariEze/Long-EZ. He brought a demonstration model up to show us last week. It is retrofittable, and consists of a white plastic background, with a clear plastic sight gauge bonded to the background. The clear part is triangular in shape. A small hole at the top and bottom allows fuel to flow into the sight gauge. Almost all of the sloshing associated with turbulence is thus eliminated. The fuel is clearly visible through the clear plastic, (crystal clear in fact!). Then Paul added the icing to the cake. He installed a small red light bulb at the bottom of the guage, which illuminates the white background and clearly illuminates the fuel, particularly the surface or maniscus of the fuel. This will allow good night visibility of fuel level. On top of all this, Paul has installed a photo electric cell (or some such gadget!), at the level that approximates 30 minutes of fuel at 75 percent power. When the fuel level drops below this level, a red light is illuminated on the instrument panel. The electronics is self testing and the whole works weighs almost nothing. The secret to the success of this remarkable fuel management system is the type of plastic used and the method of bonding the parts together. Paul

demonstrated his sight gauge by striking it a terrible blow with a hammer! The result, absolutely no damage. The type of plastic and the bonding method Paul is keeping proprietary to himself.

Paul sells a kit consisting of two gauges, electronics, two red lights and an excellent set of instructions on how to install them. RAF is pleased to recommend Paul's fuel gauges. They have all the desirable features: very light weight, simple, fuel is clearly visible day or night (what you see is what you got, absolutely the best system) and they warn you when you get to 30 minutes of fuel each side, a total of 1 hour.

Contact: Paul Prout,
4039 Olive Point Place,
Claremont, CA 91711
(714)621-0060

LORAN-C - (Once Again!)

Jim Weir of Radio Systems Technology (the designer of the EZ Nav and Comm antennas) has recently written what is probably the definitive article on Loran-C antennas for plastic airplanes. His article will be published soon in Sport Aviation. This is a much needed article and will go an awful long way toward answering the many questions our builders have on the subject.

Meanwhile we continue to hear from builders and flyers who have tried to install Loran-C, some successful, others not so. Among them, VariEze flyer, Long-EZ builder, Bill Butters of St. Louis, MO. Bill is an EE and runs an RF lab for McDonnell Douglas, has had good success with a II Morro Apollo Loran-C in his VariEze. Bill has offered to help any builder who would care to write (don't forget to include a SASE).

Ray and Nova Cullen, owners of a beautiful VariEze "Rapid Rabbit", N22809, have a SRD labs MLX Loran-C. They could not get it to operate satisfactorily until they ran into Phil Stotts, who operates Western Avionics of Fresno (4995 East Anderson, Fresno, CA 93727, (209)255-4872). Phil is a Loran whiz and is very interested in Loran installations in EZs. Ray and Nova recommend Phil to anyone having problems with an MLX. Thanks, Ray, Nova and Bill.

Herb Sanders and Ray Cole (Ray is an avionics wizard and works in the avionics division of Federal Express) have been flying a Micrologic ML5000A Loran C Navigator in Herb's Long-EZ for about 7 months now and feel they have identified most of the major problems associated with the installation of Loran in the Long-EZ. Their installation is performing very well and has been used from the Loran "waste land" of west Texas to the northeast including the navigation required for the Dulles efficiency race. Signal to noise ratio and accuracy have been consistently very good. Ground speed readouts have been within one knot of the ATC report.

The ground buss is very important to the installation. In the composite airplane, the metal components connected to this buss will be the only counterpoise (ground plane) the receiving element will see. They insured the Loran Navigator was properly grounded to this point.

They can provide additional information about the Micrologic Loran C Navigator, (they are dealers) and are also willing to share their experience with Loran installation.

Contact: Herb Sanders,
3500 S. Mendenhall,
Memphis, TN 38118
(901)365-7606

WEIGHT AND BALANCE

Recently here at RAF we have been conducting several weighings of the two Long-EZs. For test flight purposes, we needed actual center of gravity information for a certain condition. During these exercises, we were sharply reminded just how careful you have to be. Remember, accurate weight and balance data on a new airplane is critical to flight safety.

We have a calibrated certified balance beam scale. We decided it would be easier if we used 3 scales, so we borrowed two balance beam type scales. We assumed these scales were accurate and we conducted a whole series of weighings in order to establish actual pilot position (with parachute), actual fuel load position, and actual position of required ballast. It took the best part of a working day to get all of this information logged for two airplanes and then to drop reactions and measure the actual location of wheel centerlines, canard leading edges etc, etc.

At the end of all of this very careful, painstaking work, we reduced all of the data and came up with some pretty significant errors! The errors were small regarding the actual aircraft cg, but quite large when we tried to pin point the pilot's position or the position of required ballast or fuel. After much head scratching and figuring, we found that two things had "bitten" us. 1. One of the borrowed scales was inaccurate to the tune of about 15 lbs. in 400 lbs. 2. The nose gear shock spring when loaded with pilot, parachute and ballast collapsed slightly, allowing the nose wheel centerline to move aft on the scale. If this is not noticed and taken into account, your results can be very misleading.

The lesson to learn there, is that we have conducted dozens of weight and balances over the years, and should know better. We ended up with some erroneous figures that could have conceivably resulted in someone getting hurt. Do not take your scale accuracy for granted. Check it with a known weight close to the weight you expect to weigh. Be sure that the axle center line fuselage stations, as measured on the floor by dropping reactions using a level or plumb bob, are the same when the airplane is up on the scales and loaded as required.

SOLITAIRE NEWS

The prototype continues to fly very well and is much enjoyed by all who have flown it. Fourteen pilots of varying experience levels are in the log book so far. The airplane has over 135 hours total time and almost 200 flights.

Einar Enervoldson, a NASA test pilot, has turned in his article to Soaring magazine and it is slated to appear in the March issue (with a cover shot!). Einar is an extremely experienced sailplane pilot and is sure to write an unbiased article that will be very interesting to anyone interested in the Solitaire.

A lot of photography was done for the article. Oil flows were conducted and photographed. This consists of painting dirty oil (not really, but almost!) all over the wing, then flying the airplane and observing what the airflow does to the oil. This is a most interesting exercise and clearly shows laminar flow, boundary layer transition and turbulent flow.

Mike was involved in some close formation flying with a J-3 cub for photos, with the engine up and running, and with it folded away. This flight was conducted with Soledad mountain in the background and some of the shots are exceptionally fine (thanks millions Doug!). These photo flights are lots of fun, especially trying for "head on" shots!

Solitaire is flown almost every Saturday during our normal Saturday demos and of all the different airplanes we have available to fly here at RAF, we all agree that none of them compare to the Solitaire for just plain fun! Really is a ball!!

Task Research has delivered about 13 kits so far and quite a number of builders are making rapid progress judging from the letters we receive.

Now, a request. Please send us photos of your projects. We have not received any so far. We would love to publish some Solitaire project photos. How about it? Of course we also welcome progress reports, and last but not least, if you have any builder hints, or suggestions that might help other builders, send them in.

The Solitaire Owners Manual is now at the printers and will be available for $8.00 off the shelf by the time you read this. The Owners Manual contains all the information that a pilot wants to know, and as such is almost a better choice than the information package if you are wanting to know more about the airplane's capability and operating procedures.

The Solitaire prototype is on display in our hangar 6 days a week and is usually demonstrated every Saturday. If you are in the area don't hesitate to drop in and visit.

The KFM107E engine is running like a Swiss watch. So far it has required a couple of plug changes, but otherwise all we do is fill it up with gas (plus oil!) and fire it up and go flying. The electro-hydraulic engine retract mechanism has been flawless and has been absolutely maintenance free.

Don't forget to look for the March '84 issue of "Soaring".

Ken Brock Solitaire Parts
Ken Brock Mfg. has been working steadily on the Solitaire prefabricated parts and at this time has 2/3 of them ready to go. The rest should not be far behind. If you are building a Solitaire, contact Ken, to see which parts are available.

SOLITAIRE PROP
We recently tested a super little prop on the Solitaire. It was made by the Prince Aircraft Co. This prop is very light, and has what Mr. Prince calls "P" tips, little bent over tips which makes the Solitaire noticeably quieter. Rate of climb is slightly better and RAF recommends this prop to all Solitaire builders. It comes drilled and balanced to bolt right on the KFM 107E engine. Contact Prince Aircraft for prices. P.O. Box 147, Waterville, OH 43566

EZ CLUBS

Gianni Zulani, via Procaccini 68, 20154 Milano, Italy, would like to make contact with more European EZ pilots and builders. Gianni reports that his beautiful Long-EZ now has over 60 hours on it. Besides his Long-EZ, he knows of two Italian VariEzes flying and three more nearing completion.

An EZ-Association has been formed by the French VariEze and Long-EZ builders. Over 40 members, including 20 Long-EZ builders have joined already. All EZ builders in French as well as other European countries are invited to join. Contact: Jean Louis Beret, 2 rue d'Anjou, 57157 Marly, France.

The Long-EZ Squadron I and Squadron II, from the Los Angeles basin area, are planning a joint fly out/drive to RAF in Mojave. This is planned for May, probably Saturday the 19th. We at RAF welcome this idea and encourage other groups to do it. Let us know a few weeks in advance and it should make for an interesting day for all.

Change of address for B & T Propellers
As of March 1, 1984, B & T Propeller's operations, (along with all our personal worldly goods and possessions) will be relocating to our new home and shop in central California. Our new address and telephone number will be:

3850 Sherrod Road,
Mariposa, CA 95338
(209)742-6743

Until March 1, we can still be reached at 8746 Ventura Ave, Ventura, CA 93001 (805)649-2721.

Since January 1, we have been in the prop business full time, and after the move north are looking forward to lots more time for faster delivery, research and testing, and lots and lots of EZ flyins with travels around the country visiting EZ people in our new "Vari Long" - "The Beez II". Bruce and Bonnie Tifft.

LETTERS FROM BUILDERS AND FLYERS
"Dear Mr. Rutan,
Well what do you know, on July 16, 1983, six years after I obtained my prints and serial number #690, N999TT came to life and flew off into the blue just like it was meant to be. Six years seems to be quite a span of time to build a plane, but maybe not too bad considering the

wife's position when she made the statement, "A home is the most important thing in our life and you had better get your priorities in order". This cost me two years of time out of the six. Now we are both happy. I have my VariEze and she has her home. See pictures.

So much has changed in aviation and aircraft design since I worked on Ford Tri Motors for TWA back in the early 30s. Now 74 years of my life have come and gone. Of those years I have enjoyed 53 years as a pilot. When I'm not flying, often I find myself wondering if that little O-200 isn't thinking, "Here I am out of a 150 Cessna, used to chugging along at 110 mph and now I'm climbing at 2000 fpm, cruising at near 200 mph and running backwards at the same time. Sakes alive, what happening?"

I was on my way to Albuquerque, NM to attend the National Balloon races, stopped at Addison to pick up my son. About a mile ahead of me in the pattern, I saw what I thought was a VariEze. I thought, "great, a buddy VariEze". I taxied to the Beech complex and was I surprised when up taxied the Beech Starship. What a beautiful creation. Keep on surprising us Burt, with your marvelous creations.
Loren Glaser,
Swanton, OH"

"While many of you were enjoying the end of Oshkosh, my father and I were having our own sort of excitement. On August 4, 1983, N20GJ received its airworthiness certificate and on August 5, 1983, it made its first flight.

It seemed like a long time from the start of my dream to the moment of lift off. Now, with the prospect of many hours of flight in front of me, I have already begun to forget all of the anxious moments when I thought we would never finish the project.

I suppose by some people's standards, nine months to build a Long-EZ, with no previous building experience, wasn't so bad; after all, we didn't start on the Long until November 1982. Although, it seems like the year previous to starting construction was probably as taxing as the actual process of building the plane. Spending hour after hour wondering, should I buy the kit or not? Am I really capable of completing a project of this magnitude? It was during one of those "think" sessions when the answer came to me ..."Dad"

My father, Joe Sabo, had just retired and since he had a large empty garage attached to his house, (well, empty after I parked his cars in the street), I thought, what better way for him to enjoy retirement than to build his son a Long-EZ. Sound sort of crazy? Well, he bought it and off to Mojave he went for the Saturday morning demonstration, he even got a ride in 79RA. He was impressed and decided that building a Long would be fun, and EZ.

Now, he says all it takes to build a Long are three things: Patience; interpretation and perseverance. Also, he now knows why they say homebuilding is a learning experience. He learned not to let me talk him into these things.

The help we received from our designee, Kevin Morris, with his hours of work and guidance, and other veteran builders, like Jim Schultzman, who

openly shared with us his knowledge of homebuilding, made the successful completion of N20GJ all the more possible.

I want to thank Mike and everyone at RAF for answering all our questions along the way. I think it would be helpful to offer some words of encouragement to hesitant future builders, its EZ, especially if your father just retired and it helps to have a pocket full of money.
Thanks to all,
Gus Sabo,
Las Vegas, NV"

"Dear Mike,
Just a quick note to tell you that Gene Scott and I have finally finished Long-EZ, serial #180 and to enclose a couple of pictures. It took three years of weekends and about 500 gallons of Gene's character building coffee and many times it seemed like we were making no progress, but last week it was time to see if we had an airplane or just a conversation piece.

We were concerned because we were heavier than you folks would like (starter, generator, full IFR and less than perfect attention to weight in our layups) but we could put it off no longer. Last Sunday I had the privilege to take the initial flight. We had been doing high speed taxi tests for a couple of weeks and were both proficient in holding the nose off the runway, and I felt reasonably comfortable in attempting to lift it a couple of feet off the runway and then plunk it right back down (we had an 8000 feet runway). What I was unprepared for was the feeling of the Long when it left the ground ..... it turned into a solid, stable, easily controlled, great flying machine. The next trip down the runway, it was impossible not to point the nose up and get it into its real element. From that point on (as you are well aware) it was a great experience that can't be properly described.

I do have to report one note of embarrassment, however. We decided to fly with a few "minor" details left undone. One of these was the nose gear warning system. As a result, on one flight I did not get the gear completely down into the "over-center" position and it collapsed during landing, stripping the gear mechanism and folding the gear completely into the wheel well, allowing me to skid into an inglorious halt in front of the tower. Fortunately, (and I highly recommend this to other builders) we had installed a 1/4" stainless steel plate under the nose "bumper", and this saved us from any real structural damage. The runway merely sanded the paint and fiberglass directly in front of the gear. Had the plate been just a little thicker, even the paint would not have been scuffed. Moral: Every little detail IS important!

By the way, thanks to the Ken Brock organization for getting new gears to us within two days.

Like so many letters that we have read in the CP, this one is to thank you for a really great flying experience. We now have about twenty hours on N6NG and are looking forward to getting the initial time flown off so we can take it back to our home base at Gillespie field. I guarantee you it won't spend much time on the ground.
Jerry Hansen,
Las Mesa, CA"

"Dear Mike, Trish and all the rest of you who gave us so much support.

On January 6, 1981, my son Gregg and I began the building project of our Long-EZ. We completed the fuselage, wings, winglets, canard and first canopy (we broke that one) in about 10 months. Gregg left to return to school so I was by myself to build the second canopy and do many of the other "small" jobs. In April of this year I was joined by the very able Lan Mace. Together, we mounted the engine and did the finishing.

We hauled the plane via a large flatbed trailer to Santa Rosa. There we had it painted at the Truck Works with Imron paint. We worked on assembling and getting it ready for quite a few days. The first excitement was the first engine start. It started almost immediately, and ran perfectly. Everything seemed to work so I did some low speed taxiing. The low speed taxi went well and the next day I got up enough nerve to raise the nose wheel. That went well too, so it seemed to be about time to test fly. I was surprised to see how long the canard flew once it was off the ground, even with the power pulled back. Don Prestin, did a very thorough going over of everything once again. I must admit that I was getting impatient even though I knew what was being done was very important. Finally, about 4 pm Don was ready to try it out. With our ground radio on we proceeded out to the runway to watch and listen. It was an indescribable feeling to watch. In just a few seconds the canard was flying and almost immediately she was off the ground. I stood there with tears in my eyes and a lump in my throat with Evelyn tightly gripping my arm. It was a beautiful evening which added to the gracefulness of the airplane.

Don flew to 3000 feet and did the usual first flight checks. Then he came on the radio to the tower and said "This is the first flight for this plane and it flys absolutely beautifully". I was filled with joy and relief. We watched and listened for about 30 minutes and Don returned for landing. Again the excitement, does he have the gear down, will it handle ok on touchdown, were but a few of my concerns. N31AK settled perfectly onto the runway and with a huge smile Don peered out of the cockpit and reported that we had done a very good job of building, that he was even slightly envious.

I would like to thank Burt and Mike for the development of plans even an amateur can follow and thank you Mike for our always more than adequate phone support. Thank you too, Trish, for being helpful and friendly on the phone. Building this airplane and seeing it fly has to be one of the most exciting and gratifying things I have ever done. Now, I'm looking forward to learning all about the airplane from the front seat.
Warm regards,
Ken Hansen,
Mendocino, CA"

ACCIDENTS AND INCIDENTS
The Canard Pusher newsletter reports on accidents, discusses their conditions and causes in order to disseminate any information to

operators of similar aircraft. This information is published here purely in the hope that possibly someone in the future may be saved from the same situation. It should be recognized in discussions of accident conditions or causes that generally this information is preliminary since it is being published before the availability of the FAA or NTSB accident reports.

A modified Long-EZ crashed on the Southern California coast. (This accident was mentioned briefly in CP37). We have actively been trying to determine a possible cause on this one but so far have been frustrated. Although there were a few eye-witnesses, their information is sketchy and contradictory. Several witnesses reported seeing the aircraft flying low along the beach and pulling up into steeply banked turns. No one we have talked to saw the actual impact. We have carefully examined the wreckage and it appears that the airplane struck the beach with very little forward speed in a flat attitude. There was no evidence of rotation. This aircraft has a non standard fuel system. A header tank containing 5 gallons was built into the space over the centersection spar, aft of the passenger's head. This tank was kept full with a fuel pump at all times, and the engine was gravity fed from this header tank.

The aft cg, and the vertical cg of this fuel possibly contributed to an unacceptably aft cg condition for the airplane, particularly at higher deck angles, when the vertical cg would cause a worse aft cg condition. We know this aircraft made its first flight with 30 lbs of ballast in the nose. There was no evidence of any ballast in the wreckage.

NOTE: We would like to reiterate what we said in CP 37. Due to individual builder tolerance build-ups, and contour variances, you cannot assume that your airplane will behave exactly like the original prototype, N79RA. Because of possible variances, we are now making the aft cg limit of F.S. 103 (recommended in CP 37), a mandatory permanent change.

An Australian VariEze struck a power transmission line. The airplane crashed into a reservoir. The pilot and the passenger were fatally injured. The weather was reported a factor, for in order to stay in VMC conditions they were flying at low altitude.

A Southern California VariEze crashed while attempting to land. The pilot was fatally injured. The weather was clear with unrestricted visibility. The wind was directly down the runway at 5 knots. The pilot made two attempts to land. Making a second go around, the airplane climbed steeply, turned left, the bank angle increased to 90 degrees, hesitated for one or two seconds, the rolled inverted and crashed nose down in a wings level, inverted attitude. No control systems or engine problems were found. This pilot had recently bought the airplane. He had entered VariEze time in his log book. However, evidence suggested he was on his first flight and had improperly logged time for insurance purposes. He was a low time pilot with very little recent time. The probable cause of this accident was lack of experience and low proficiency.

A VariEze crashed in Arizona in front of several eye witnesses. The pilot was fatally injured. The aircraft made several high speed low passes in the vicinity of the witnesses, then on the last pass, pulled

up steeply and initiated a roll. The roll maneuver was not quite completed and aircraft struck the ground. This pilot was observed a few days earlier doing "aggressive aerobatics" in his VariEze. The aircraft had only 14 hours total time since new.

A Long-EZ ran off the end of the runway during an attempt to take off in the threat of a rapidly approaching thunder storm. The pilot broke both ankles and passenger suffered some heavy bruising when the aircraft overturned and was seriously damaged. A thunderstorm was closing in from the north. The wind was only about 5 knots when the pilot began to taxi out. He elected to take off downwind. According to eye witnesses the wind rapidly built up to an estimated 45 knots on the tail during the aircraft's take off roll. In the pilot's words "the accident was caused by pilot judgement, not by the plane".

A California VariEze, travelling through Arizona was destroyed in a weather related accident. The pilot and passenger were both fatally injured. The weather was reported at 500 foot ceiling, poor visibility in sleet and freezing rain.

The aircraft totally disintegrated in the air. Very little damage was due to the impact with the ground. We spent a lot of time looking for possible causes, and we carefully examined all of the pieces which were found. The wreckage was spread down wind for over two miles. The damage showed signs of extreme high speed flutter, rather than overload due to excessive g. This accident was probably caused by the pilot pushing on into bad weather, or possibly trying to climb over bad weather. He may have become disoriented or overcome by hypoxia, the aircraft probably ended up straight down at very high speed. Finally it reached a speed beyond anything intended for this design, when it literally experienced flutter over the entire airframe.

The important point to note is that there was no evidence of a massive 'g' overload, such as would be expected if the pilot tried to pull out of a high speed dive, was found. All of the evidence points to total catastrophic failure due to high frequency, divergent flutter. The damage could only have resulted from and extreme overspeed condition possibly in the region of 400 knots plus.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category Definition

MAN-GRD Mandatory, ground the aircraft. Do not fly until the change has been accomplished.

MAN-XXHR Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.

DES Desired - strongly recommended but not requiring grounding of the aircraft.

OPT Optional - does not effect flight safety.

OBS Obsoleted by a later change.

MEO Minor error or omission.

VARIEZE PLANS CHANGES

There are no VariEze plans changes this issue.

LONG-EZ PLANS CHANGES

NOTE: Plans change LPC #116, CP 37, this is a mandatory change.

CAUTION: A number of builders have not installed the metal shields in the wing root areas as called out in Section I, Page 23-3 of Long-EZ plans. It is possible that exhaust system radiated heat can damage the foam in the root of the wing. The metal shield eliminates this problem.

SOLITAIRE PLANS CHANGES

SPC #24 -
Section I, Page 8-4. Top paragraph, right column, call out of 6" x 6" x .025 aluminum should be one 6" x 6" x .032 2024T3 and two 5" x 6" x .032 2024T3 aluminum. Note, the outboard one is 6" from the end of the elevator.

SPC #25 -
Section I, Page 2-2. Spruce and Wicks parts list. Change 134" 1/2" dia. steel to 136".

SPC #26
Section I, Page 5-1, Step III. Bulkhead placement. Bulkheads 22.5, 45 and 72 are located aft of the scribe line. Bulkhead 112.5 is located in front of the scribe line at 112.75 and bulkhead 132.2 is located forward of the scribe line at F.S. 132.3.

SPC #27
Section I, Page 8-6. Rivets. 13 lines up from the bottom left hand column calls out MS20426-3-4 change to MSC-32, Page 6-1, Step I, line 18 calls out AW426-3-7-4A change to MSC-32 pop rivets. Page 6-1, Step II last sentence calls out BSC-44 pop rivets change to Avex 1604-0412.

SPC #28
Section I, Page 7-5, Detail A. Change the bolt call out from an AN3-10A to an AN3-11A. these are the rudder pivot bolts.

SPC #29
Section I, Page 5-1, Step II. Second sentence above figure 5-4 says to coil up 4 inches of tubing and tape it to the fuselage side. This should be 4 feet.

SPC #30
Section I, Chapter 5. The overview calls for the right fuselage half to go down into the fixtures which are setup on the floor. But the rest of the chapter calls out the left half. Although either half would work, it is probably simpler to put the right half in the fixtures because this is the half with the double joggle and cleanup of excess micro would be simpler. In order to put the right half in the fixture, figure 5-1 would need to be reversed as shown. **FIGURE 5-1 OMITTED**

SPC #31
Section I, Page 703, Step IX. After the sentence which reads "wet this out only to 1" and the tape will stick", add the sentence "apply a second ply UND at -45 degrees overlapping 1" onto the vertical. Lap this at the top and tape down as you did the first ply, wetting only 1"". The first ply was installed at +45 degrees.

SPC #32
Section I, Page 11-2. At the end of the page, add: the interior layup, slurry the foam inside the nose cone and lay up one ply of BID overlapping as necessary. This ply laps across the shear web of the canard. Layup a second ply of BID 2.5" wide from the lip inboard as shown in Figures 11-4 and 11-6 all around the attach area. Lap 1" as necessary. Peel ply the edges and knife trim when ready.

SPC #33
Section I, Page 7-5. The hole for the rudder hinge pin in the SRH-4 and SRH-8 are called out as .312 diameter. Change this to a #12 drill to fit an AN3-11A bolt.

SPC #34
Section I, Page 9-2. The third drawing from the top of the page shows the dimension from B.L. 11.5 to B.L. 179.5 as 238.5, change this to 168.0" as shown on the drawing above on Page 9-2.

SPC #35 Section I, Page 9-1. Overview states the layout is for a right wing, change this to a left wing. All other drawings in this chapter show a left wing.

SPC #36 Section I, Page 6-1, Step I. Calls out to have K3000-3 nutplates installed onto the SRH-10, change these to MK2000-3. Change the call out on Figure 7-4 and in the bill of materials on page 2-2.

SPC #37 Section I, Page 2-2. Spruce and Wicks parts list of hardware reads 86" - 5/16" diameter steel rod (any steel). Change to 172" - 5/16" diameter steel rod (any steel). NOTE: These and the 1/2" diameter steel rod in the next line on the parts list are counter

balance weights. These can be installed in several short pieces. The prototype was done with 3 foot sections.

SOLITAIRE BUILDER HINTS

BH #4
Section I, Page 8-6, Step X, 12th line down. See Page 10-3 for a better explanation and pictures of how the hinge line system is installed.

BH #5
Section I, Page 7-1, Step I. The trailing edge of templates A and B go on the end of the foam block with taper cut on it as shown in Figure 7-2. There has also been some confusion as to the fact that core A-B is cut from the same block as core C-D. After cutting the core C-D, remove the core and trim the block as shown in Figure 7-2. Then cut core A-B. Hold both cores in position before glassing to verify that the leading edge of the vertical stabilizer lines up with the leading edge of core A-B and that with the block in this position the trailing edge of core A-B and the rudder trailing edge, core C-D are also in alignment.

BH #6
Bulkheads taped in place with one ply of BID each side wherever you can reach.

BH #7 Section I, Page 9-2, Step III. When joining the spars to the wing core it is a good idea to round the corner on the foam wing cores where the glass skins will lap onto the spar before microing the spar in place, rather than afterwards as called out in the plans. A drawing showing the 0.2" radius is shown on Page 9-3.

BUILDER HINTS

Long-EZ - Long-EZ builder Fox Smith, sent this one in and although we have not tried it, it sounds great. He used a Morse #TAIO-5/8" high speed hole saw bit, called "The Real McCoy". Reportedly, it simply 'walked' through the aluminum/glass wing attach pads, when mounting the wings to the centersection spar.

VariEze and Long-EZ - Aileron hinge pin wear. This problem still has not gone away, even with the "bent" hinge pins. Rodie Rodewald originally suggested a modification, and Dick Kreidel has had it installed for 125 hours with "zero slop". It consists of a piece of thin-walled teflon tubing inserted through the hinge, with a piece of stainless steel welding rod 1/16" dia. for a hinge pin. The teflon tube makes an excellent tight fitting 'liner' for the hinge pin that does not allow any rattling or looseness, yet allows smooth pivoting action.

The only drawback is that it is tricky to install. You will need a piece of teflon tube a little more than twice the length of each hinge, for each hinge. Use and Xacto knife to slit the tube for half its length. **SKETCH OMITTED**

Now fold it up to reduce its diameter, and push it through the hinge. When you have it all the way through, (the unslit half is not into the hinge yet) now insert your welding rod hinge pin into the unslit half of the teflon tube, then pull the whole works through the hinge until your new hinge pin and teflon liner are properly aligned in the hinge. The teflon tube can be obtained from McMaster Carr, part #5335K17, McMaster-Carr Co., P.O. Box 54960, Los Angeles, CA 90054, (213)945-2811

Long-EZ - Bill Smullin, Long-EZ builder has available an excellent spherical bearing that can easily be installed in the wing root instead of the phenolic block that inevitably rattles and allows play in the aileron torque tube and thus play in your roll control system. These spherical bearings are easy to install, just drill the phenolic block out to fit (a hole saw works well) and flox the bearing into the phenolic block. A couple of plies of BID over the bearing, just lapping onto the edge of the bearing guarantees it will not come out. The ID of the bearing is an excellent fit on the steel tube (CS152) in the aileron torque tube CS151. Bill can supply these spherical bearings to builders for $12.00 a pair.
Contact: Bill Smullins,
1000 North San Gabriel,
Azuza, CA 91702
(213)969-3979 or
(213)963-4706

Long-EZ - Richard Marr suggests this method to roll your Long-EZ over after you have your fuel strakes and centersection installed. Bolt a 1" x 10" pine board to your 3 wing attach points on one side. Make the board long enough to protrude about 15" beyond the outboard tip of the centersection spar as shown. Now if you set the nose on a piece of carpet or similar pad, it is possible (though not without some strain) for one person to roll it over. The pine board keeps the centersection strake off the ground. Two people can do the job very easily.
SKETCH OMITTED

VariEze - Comm antenna. This looks like a good one. Bob Beard sent this in. He installed a standard RST copper foil antenna up the aft face of his front seat bulkhead. The upper element runs up the aft face of the roll over structure. The bottom tip of the lower element runs down into the bottom right hand corner. Each element is 20 1/4" long. The elements can be as close as 1/8" in the middle, but must not touch each other.

VariEze and Long-EZ - Transponder antenna. Bob Beard installed his antenna forward of his right rudder pedal on the floor. An aluminum ground plane at least 5" in diameter (larger is better) is siliconed to the floor. The antenna is bolted to the ground plane so it sticks out through the bottom about 1". This antenna really works great.

VariEze, Long-EZ and Solitaire - Epoxy brushes may be used several times over without washing them out, if you wipe most of the epoxy out of the bristles with a paper towel, then place it in a freezer. The low temperature slows the cure cycle dramatically. The next day, you can take it out of the freezer, stir it around in a fresh cup of "ready to use" epoxy and within a few seconds, the brush will soften until it is like new. We have reused a single brush many times using this

technique. The only problem will be if you don't need the brush for a couple of weeks. Then it will have cured. The freezer slows down the cure. It does not stop it! As long as you are busy doing layups every day or every two or three days, this trick works.

FOR SALE

Brand new Lycoming O-235-L2C, removed from C-152s. Low time - $4200, high time - $3200

Contact: Heimo Trathnigg
P.O. Box 2122
Farmington, NM 87499

Lycoming O-235-L2C, 1310 hours total time, removed from a Tomahawk. With all accessories, flange ok. $3200.

Contact: Trev Zander
(314)296-4157

Lycoming O-235-L2C, 1945 hours total time.

Contact: John Cova
(503)862-2492

Lycoming O-235-L2C, 1400 hours total time, Removed from Grumman TR2. Includes carb and Slick mags.

Contact: Bruce Evans
(805)824-2645

Accessories for a Continental O-200A, exhaust system, starter, 60 amp alternator S4LN-21 mags.

Contact: Bill Morgan
6295 White Mill Road
Fairburn, GA 30213
(404)964-9408

Flight Research Mufflers for VariEze, stainless steel with integral heat muff for Continental O-200. $250, (cost $325 new).

Contact: Phil Wimberly
1926 Pinehurst
Los Angeles, CA 90068
(213)876-2129

Mule Furgerson has his "Oshkosh '83" video tape, with lots of EZs for sale. Running time is 2 hours in VHS or Beta, $39.95 plus shipping.

Contact: Video Service,
Rt 1 Box 654
Boomer, NC 28606
(919)921-3019

B & C Specialty Products new Linear Regulator will be available in February. The regulator will work with their 35 amp alternator or your standard aircraft alternator. Also included are the following features:

1. Will work with standard aircraft alternators, or automotive type 14 or 28 volts.
2. Over-voltage protection with built-in logic to prevent nuisance tripping from inductive loads.

3. Flashing high-low voltage warning lights with 100 percent press-to-test of associated circuitry.
4. Uses linear type regulation to reduce RFI.

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5. Ideal for use in composite aircraft with Loran C or ADF.
6. Regulator output is short circuit protected.

B & C is also selling the Apollo I Loran C for $1,590.00, which includes the preamp and radio tray. The Loran C is only 2" high, 6 1/4" wide and 11" deep.

If you want to save a lot of time when you are cutting your fiberglass cloth, try a heavy duty rotary cutter (similar to a pizza cutter). B & C has a special price of $11.00 for one knife with one extra blade. Additional blades are available for $2.50 each.

The Lightweight 12 amp gear driven alternator that B & C has been making for the Continental 0-200 is still available.

If you would like more information on any of these products please send your aircraft and engine type along with a long SASE to:

B & C Speciality
518 Sunnyside Court
Newton, KS 67114

WANTED

Bill needs a Marvel Shebler MA3PA or MA35PA carb for his Lycoming 0-235.
Contact: Bill Allen
Lilleybrook Lodge
Cirencester Rd, Charlton Kings
Cheltenham, Gloustershire
England

Lycoming 0-360 A1A or A1D. Ok if it needs and overhaul, but no damage.
Contact: Rodie Rodewald
68-361 Crozier Drive
Waialua, HI 96791
(808)637-5515

Hanger to share at Brackett Field, La Verne, CA. Room for Long-EZ, VariEze or smaller.
Contact: Max Overholtzer
(818)966-2060 home
(818)357-6061 work

Original VariEze fuel strakes.
Contact: Frank Nickell
210 Patrick Drive
Pacheco, CA 94533
(415)934-6050

VARIVIGGEN NEWS

The big news is that we have a new VariViggen flying. Congratulations Frank Stites!! Frank has completed and flown his VariViggen, N99VV. Frank reports that he was conducting high speed taxi tests with zero reflex set, when to his surprise he found himself 20 feet in the air. Frank had previously been out to Mojave and had had a back seat check out in N27MS. But even so, he reports being behind the airplane, and had some difficulty getting it back on the ground. The problem arose from not being prepared to fly. Now hear this: If you decide to do a high speed taxi run down a runway, you had better be ready to fly, because unless you are quite proficient at high speed taxi tests, you almost certainly will find yourself off the ground. The trick is to be prepared, both mentally as well as physically. That is, have the airplane completely preflighted and prepared for flight.

Frank later went on to an uneventful 30 minute "second" flight. He finds the airplane very quick on the controls, compared to what he is used to, but is very pleased to have finally achieved the goal of flight.

We are happy to report that Arthur Schwartz has got his Viggen flying once again. Arthur has 246 hours on his "Birdie". He had the misfortune about 5 months ago of having the right main gear shock strut fail at the rod end bearing (not per plans). This allowed the trailing link suspension to swing back and lock the tire. This caused the airplane to skid off the runway into a field of alfalfa. Striking a two foot high embankment, the nose gear was torn out by the roots, causing lots of damage. The mains also folded causing more damage. Fortunately the aircraft did not flip over, and there was no fire. Arthur got out with a few bruises. It speaks well for his tenacity and enthusiasm, for little more than 4 months later he had repaired all the damage and was flying again. Good for you Arthur, perhaps you will be at Oshkosh this year?

Wayne Wilkins reports that he is hanging his Lycoming 0-320 and has changed his MG-4s per the CP change for 4130 MG-4s.

Orv Winfield reports that his Viggen is now covered and ready for finishing. SP wings are complete and installed. Engine is hung and partially hooked up. His photo looks promising. Keep it up Orv, not too far to go now!

Emerald Ullman reports that after logging over 3600 man hours he estimates that his Viggen is 80% complete. Viggens don't come easy.

Joe Rayne of Clinton, Michigan is flying a real mind blower! Joe used a set of Viggen plans for a baseline and redesigned it into an all aluminum (except for cowling and nose cone) version, see photos. Quite a unique bird, and quite a unique achievement. Congratulations Joe, hopefully we will see this one at Oshkosh?

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

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a unique bird, and quite a unique achievement. Congratulations Joe, hopefully we will see this one at Oshkosh?

Joe Rayne after first flight, Congratulations! Joe in flight. High deck angle is because this photo was taken from a friend's "Stampe" biplane at 80 mph.

Jim Schimidt of St. Croix of Park Falls, WI with the proof of concept prototype 1/5 scale Long-EZ model. This stand off scale model will soon be available as a kit. It not only looks like a "Long", it flies like a "Long".

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Sally with Solitaire on the Mojave ramp. Note the pitot static boom mounted for airspeed calibration for Einar Enerboldson's "Soaring" article.

Loren Glaser with his beautiful VariEze AND brick home that he built. Loren is a very young 74 years of age, 53 years of which he has been a pilot.

Gene Scott and Jerry Hansen's immaculate Long-EZ. This one is a real beauty.

Bill Rice has over 300 hours on his VariEze N103B and now he has flown his Long-EZ N9JB, which he built with friend Jim Hopelain.

Sun Nilsson taxiing out for his first flight in his Long-EZ. There are two Long-EZ builder/flyers in Sweden named Sune Nilsson!!

A typical Long-EZ "nose gear area" installation. Note the furniture clamp holding the NG-30 assembly to the F22 bulkhead.

This is Gene Scott and Jerry Hansen's instrument panel! Wow, everything fits and it really does not look crowded.

Its amazing! VariEzes continue to hatch with regularity. How about this paint job? Red on white, very striking. Congratulations, Raymond Mucha.

DEFIANT
HOMEBUILT
FOUR-PLACE
TWIN

Introduction
For some time you have been reading about the four place, push pull twin engine Defiant. After five years of enjoying a "one of a kind" aircraft, Burt Rutan has made the decision to release Defiant drawings to the homebuilder. In late 1981 Burt contacted Fred Keller of

Anchorage, Alaska and asked if Fred would be interested in building a Defiant and keeping a complete log with updated drawings and photographs as he was building. Fred agreed and at the EAA convention in Oshkosh 1983, Fred's Defiant was on display. Some changes have been made to the original aircraft such as, an increase in span on both main wings and canard and a revised aileron for lighter control forces. The back seat folds forward for a `station wagon' effect that allows two people to use the baggage area for sleeping. The canopy opening has been improved for easier entry. The fuselage has been changed to allow more head room for the back seat passengers.

Fred Keller is now completing the detailed plans for the Defiant. These will be available from RAF in March 1984. The builder support will be from Fred for plans interpretation, and from RAF for general `how to' on the construction.

Description
The Defiant is a four place, canard-type twin with two 4 cylinder Lycoming engines. Engine power can be 150, 160 or 180 horsepower per engine. It's canard configuration provides several important benefits as compared to conventional twins; (1) Packaging is considerably more efficient - it has a standard-size cabin in an airframe whose whetted area is only 60% that of a conventional light twin. (2) The smaller airframe also has reduced structural load paths allowing a structure much lighter than a conventional twin while having better durability and a higher `g' capability. (3) The tandem wings allow natural aerodynamic angle-of-attack limiting, thus, the airplane is stall resistant. (4) The tandem wings, using winglets for directional stability provide a 30% reduction in induced drag compared to a conventional aircraft with the same span loading. (5) Flight control systems are simpler and lighter. Elevators are only two feet from the control sticks and they provide a flap effect without having separate flaps, thus, at low speed the canard has a deflected full span slotted flap, yet the pilot has no flap control to adjust.

The rudder is only one foot from the pilot's rudder pedals. It is designed to provide control, yet have no effect on stability. Ailerons on the aft wing are controlled from their inboard end such that the entire wing and vertical fin assembly is built without any moving parts.

The small chord elevators and ailerons allow control forces compatible with a side-arm control stick. This allows more precise, less fatiguing control and provides improved use of primary instrument panel space.

Instead of the complex electrical system with one buss and battery tied to two alternators, the Defiant has two simple separate electrical systems, each with its own battery and alternator. IFR avionics are split to both systems so that no single failure can effect essential equipment. Both engines can be started simultaneously. The two systems can be tied together to run all equipment from one alternator in the event of a failure. Also, a low battery can be charged by the other engine without ground electrical equipment. Thus, the electricals are much like conventional fuel systems, i.e., completely independent but with "crossfeed" available in an emergency.

The fuel system consists of a 58-gallon tank with a large sump for each engine. The two systems are independent and require no pilot action for normal operations. Crossfeed is available. The sumps are accurately gauged and are equipped with low level warnings, such that when 45 minutes fuel remain the pilot not only has a warning light, but has a gauge that moves full scale for the last 45 minutes fuel. He can then intelligently plan his options when fuel is low, knowing quantity to within 1/3 gallon of fuel. The last one half gallon of fuel can be used in all normal attitudes. While appearing small outside, the Defiant is quite roomy inside. It has a cockpit width at the elbows of 46 inches (43 inches at rear seats). Knee and leg room for the backseats is a full eight inches more than current light twins. The Defiant has a large baggage area aft of the back seat and even larger if the back seat is layed flat. Two six foot people could use this area to sleep in. The unique semi-supine seats provide a significant advantage in comfort over conventional seats. With a conventional seat, the upright pilot carries all his weight on the buttocks and small portion of the thigh. The Defiant's seat is reclined a full seven degrees more and armrests and headrests are provided for all seats. Thus the body weight is distributed over the lumbar, forearms, thighs and head, rather than being concentrated in the tailbone area. In general, a person who normally finds himself fatigued after a two to three hour flight, will be comfortable even twice that long in a well supported reclining seat.

The side arm controller and throttle system places the pilot's arm in a more natural position while flying and frees his lap area so he can use an airline type lunch tray for maps, approach plates, computers or lunch. Space efficiency and panel visibility is considerably increased when the control wheels are eliminated.

The aircraft is very basic in its systems. It will never require maintenance nor have an AD issued on its flaps, retractable main gear, cowl flaps, governors, hydraulic system, oleos, stall warning, nor emergency gear extension system, since these were eliminated in the basic design. The remaining systems (flight controls, power plant installation, electrical system, fuel system, etc) are all very basic and simple compared to the conventional light twin. This saves weight, reduces maintenance and increases availability and reliability.

Visibility, particularly in the pattern, is superior to current light twins. The canard wing is at approximately the same height as the nacelles on a Seneca II. Forward downward visibility is adequate over the canard during normal climb, approach and landing flare. Absence of a wing above or below the cockpit area results in a welcome improvement in visibility over conventional aircraft.

Flying Qualities
Flying qualities are conventional with the following exceptions: (1) Spiral stability is positive and speed stability is high, such that the aircraft flies "hands off" indefinitely once trimmed, even in turbulence. (2) There are no pitch or roll trim changes due to configuration or power. Once trimmed at approach speed it will hold that speed hands off during power changes and landing gear extension. The airplane is very stiff in yaw with high damping. Yaw oscillations damp in one to two cycles after a side slip release, as compared to three to six cycles for a conventional light twin. Roll rate is

excellent. Adverse yaw is low enough that all normal maneuvering can be done with "feet-off-pedals" resulting in less than one-half-ball yaw excursions.

The Defiant is a very stable IFR platform with a very solid "big airplane" feel. It holds a desired approach speed with less attention than a conventional light twin.

Performance

In general, simplified systems means reduced performance. Not true for the Defiant. Overall performance and efficiency is significantly better than conventional light twins. Data discussed below are for 160 BHP engines. Time-to-climb to 12,000 feet is 10.3 minutes with full fuel and four adults and 7.7 minutes with two adults and 400 nm fuel. At maximum cruise speed of 184 knots (75% power), total fuel flow is only 17.8 gal/hr giving a 1.74 nm/lb economy and a range of 1044 nm with reserves. At 55% power (168 knots) total fuel flow is 13.9 gal/hr giving 2.00 nm/lb economy and a range of 1208 nm with reserves. At low cruise (40% power, 150 knots) range can be stretched to over 1300 nm with reserves. At equal loading and speeds, Defiant gets over 50% more miles per gallon than a conventional light twin! Holding capability is also impressive. At medium weight Defiant can remain aloft on only 40 thrust horse power (64 brake hp) for a maximum endurance of over 14 hours. The excellent two-engine climb capability allows cruise altitudes as high as 18,000 feet with 4 adults and full fuel. The prototype has climbed above 28,000 feet at light weight, single place. This climb capability is far in excess of similarly equipped light aircraft. (Fixed pitch prop and no turbocharger).

Single Engine Capability

In contrast to all other light twins, in which after engine failure a many-step procedure must be accurately followed during which aircraft control and airspeed control are critical, the Defiant makes no demands on the pilot to follow procedures. He can even use any excess airspeed over the minimum full-aft-stick speed to zoom over an obstacle. Once over the obstacle he can maintain aft stick and climb away (single engine) or accelerate without altitude loss to best climb speed. This unique capability is best shown by comparing the Defiant's takeoff profile with that of a conventional light twin (figure I). Both airplanes are at maximum gross weight. Both aircraft experience failure of the critical engine at 10 foot height. Neither aircraft can land and stop in the remaining runway, so they must continue the take off. The conventional twin pilot must immediately do the following: (1) raise gear (2) identify failed engine (3) retard throttle on failed engine (4) cutoff mixture on failed engine, (5) feather failed engine, (6) bank five degrees toward operative engine, (7) carefully raise flaps, (8) Maintain 82 KIAS to 50 foot altitude. After 50 feet (accel-go procedure) he accels to best angle of climb speed (95 knots) and thus, does the best he can do to clear any obstacles. Height-distance profile for this is shown as the lower line in Figure I. Note that even though his eventual climb gradient is adequate (193 feet per nautical mile) the 310 is nearly 4500 feet from brake release before reaching the 50 foot height, and that unless airspeed control and procedures are accurate he will likely crash during this climb segment.

The 310 is one of the best light twins to perform this profile. The "light-light" twin types will either have less performance or will strike the ground during segment A.

The other lines on Figure 1 represent the performance obtained by the Defiant for several conditions. The lower lines are obtained if the pilot elects to fly at the best single engine rate-of-climb speed. Note that if the pilot does nothing but maintain airspeed he will clear the 50-ft obstacle at 3300 feet, even with the gear down.

FIGURE 1 OMITTED

The upper lines on Figure 1 indicate an even more interesting capability of the Defiant. Suppose a tall obstacle exists at the end of the runway. The Defiant pilot can pull back the stick to zoom over the obstacle, even slowing to his minimum speed of 65 knots. After clearing the obstacle he can merely hold the stick aft and safely climb away even if he leaves the gear down (no procedure). If any conventional light twin attempts this, an accident will result, since, they cannot climb when near min control speed or stall speed. If desired, a standard rate turn can be initiated following an engine failure during lift off at gross weight.

Specifications and Performance
(with 160 BHP engines, fixed Props).

Engines (2)	Lycoming 0-320
Seats	4
Basic Empty Weight	1600 lb.
Equipped Empty Weight	1680 lb.
Equipped useful Load	1270 lb.
Gross Weight	2950 lb.
Fuel Capacity	115 gallons
Span	31.4 feet
Wing Area	133 square feet
Wing Loading	22.2 lb/square feet
Power Loading	9.2 lbs/hp
Payload with full fuel	660 lbs.
Max Cruise (70%)	184 knots
Fuel flow at max cruise	17.8 gph.
Range at max cruise (45 min reserve)	1044 nm
Economy Cruise (55%)	168 knots
Fuel flow at economy cruise	13.9 gph.
Range at economy cruise (45 min reserve)	1208 nm
Climb Rate (2950 lbs)	1500 fpm
Climb Rate (2220 lbs)	1900 fpm
Single Engine climb (2950 lb)	310 fpm
Single engine service ceiling (2950 lb)	6500 ft.
Single Engine Climb (2200 lb)	550 fpm
Stall Speed (2950 lb)	64 knots
Stall Speed (2200 lb)	58 knots

Cost and Time to Build the Defiant
The cost of the materials list has not been completed at this time, but we estimate the cost of building the Defiant will be approximately "two

Long-EZs", between $20,000 and $30,000. Remember that avionics can cost you as little as $1000 or as much as you wish to pay.

Time to build the Defiant, again will be "two Long-EZs" as it is the same type of construction, just more. A competent builder can build a Defiant in as little as 2000 man hours. Until the plans are completed, it is difficult to say how many of the parts will be available prefabricated and this would make a difference to the time to build.

	U.S.A.	Overseas
Canard Pusher Newsletter	$ 6.75	$ 8.75
Defiant Plans - Section I	$490.00	$510.00
Defiant Engine Installation	not available at this time.	
Defiant Owners Manual	not available at this time.	

SOLITAIRE -
A
Self-Launching
Sailplane

THE PROBLEM
For a long time soaring has been an exclusive sport requiring a special license and training. Soaring in a glider of enough performance to allow the average pilot to feel the true thrill of 'engineless' flight has been expensive enough to severely limit the number of people who enter the sport. The current interest in ultralight and light sport aircraft has reached an all-time high.

THE CHALLENGE
The Soaring Society of America recognized the problem. Other segments of homebuilt aircraft were experiencing great interest and activity on the part of designers and the general public. The sailplane market was not getting its share of the attention. To correct this, the SSA issued a challenge in the form of a contest. Develop a self-launching sailplane capable of take off and the ability to climb to altitude without the use of a tow plane. The new design could be flown without the special license required of a sailplane pilot, just a private pilot's license. The aircraft must be easy to fly, as well as quick and easy to build. Strict rules were set up and an actual structural test of the finished aircraft was required. The Solitaire was designed around these goals and achieved these and more.

THE WINNER
At the flyoff held in Tehachapi, California, on September 6, 1982, the judges studied the entries, flew the SOLITAIRE and unanimously declared it the winner.

WHAT
The SOLITAIRE is a single-place self-launching sailplane that is fitted with an engine package that folds into the nose of the aircraft after

it pulls the SOLITAIRE to soaring altitude. With the engine folded, it has a L/D of 32 to 1 giving it true soaring capability. The engine can be deployed and restarted inflight using its electric starter. The canard concept results in high resistance to inadvertent stalls and spins. Its 'spoilflap' descent control system has been acclaimed as "excellent" by all evaluators, providing crisp, variable glide path control without trim upsets. Unlike conventional sailplanes the pilot sits within the allowable cg range.

HOW

The SOLITAIRE uses the proven materials and methods pioneered by Burt Rutan and used in the VariEze and Long-EZ, two of the most successful aircraft ever designed for the homebuilder. The wings are special uni-directional fiberglass cloth and epoxy resin. They are built using the moldless composite technique developed in the VariEze and consist of prefabricated 'S' glass spars and a solid foam wing core. The fuselage comes as two prefabricated halves. The bulkheads are available prefab and the wooden fixtures and templates will be available premanufactured. The canopy comes installed in the frame and the turtle deck is available prefabricated. All of the metal parts and complete landing gear components are available premachined. The premolded parts are of aerospace quality. Construction consists of prepreg skins with a honeycomb core and an adhesive film to bond them together. These are then vacuum bagged and cured in an oven. In short, this aircraft will have more prefabricated parts than any previous design from Rutan Aircraft Factory. Of the available prefabricated parts, the builder can buy all or as few parts as he wishes. We estimate that an average builder, purchasing all the available parts could build the aircraft in 400 hours at a cost of between $7000 and $9000. When the quality of parts and the ease of building is considered the value of the SOLITAIRE becomes apparent.

SUPPORT

Rutan Aircraft Factory support has been a key factor in the history of success with homebuilt aircraft. When you buy plans, you become one of a family of builders. Rutan Aircraft prides itself on its builder support program. We will answer questions either by phone or in writing. Builders are also welcome to bring parts to Mojave for inspections and advice. The quarterly newsletter is mandatory when you are building, as it provides continuing builder hints, ideas and plan updates.

ALL RAW MATERIALS.

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow, Box 424,
Fullerton, CA 92632
(619) 870-7551
Catalog $4

Near St. Louis.
WICKS AIRCRAFT
410 Pine Street,
Highland, IL 62249
(618) 654-7447
Catalog $3

ALL PREFAB MACHINE PARTS.

KEN BROCK MANUFACTURING
11852 Western Ave., Stanton, CA 90680
(714) 898-4366
Catalog $3

PREFAB FUSELAGE, CANOPY, TURTLE DECK, WING SPARS, SEAT PAN.
TASK RESEARCH
848 East Santa Maria, Santa Paula, CA 93060
(805) 525-4545

SPECIFICATIONS
SOLITAIRE - RAF Model 77-6

Empty Weight ..... 380 lbs.
Gross Weight ..... 620 lbs.
Total Wing Area ..... 102.44 square ft.
Span ..... 41.75 ft.
Wing Loading ..... 6.05 lbs./square ft
Engine ..... KFM 107E
BHP ..... 23 at 6000 RPM

Fuel ..... 5 gal. premixed @ 40:1
L/D ..... 32/1 at 50 knots
Min. Sink ..... 150 ft./mn @ 40 knots (approx.)
Descent Control ..... Spoilflaps usable to Vne
Min. Flying Speed ..... 32 knots
Vne ..... 115 knots
CG ..... unaffected by pilot weight

SOLITAIRE DOCUMENTATION
Canard Pusher Newsletter published quarterly.
One year's subscription $6.75

Section I - Manufacturing Manual $225.00
This is the complete education and construction manual for building the entire SOLITAIRE except for the engine installation. This manual consists of a spiral book 11" x 17" together with a set of 23" x 33" drawings, which include all necessary full-size templates, jigs and cross sections.

Brief Long-EZ specifications/Performance
Engine Lycoming 0-235 108 hp.

Span	26.1ft
Area	94.8 sq. ft.
Empty Basic	750 lb.
Empty Equipped	800 lb.
Solo Weight	1000 lb
Gross Weight	1425 lb
Max Fuel	52 gal.
Cabin L/W/H	100/23/37 in.
Takeoff (solo/gross)	600/950 ft
Climb (solo/gross)	1750/1250 fpm
Cruise 75% 8000 ft	186 mph
Cruise 40% 12000 ft	146 mph
Top Speed - Sea Level	193 mph
Max range * 75% (solo/2 place)	1380/1150 mi
Max range * 40% (solo/2 place)	2070/1690 mi

Ceiling (solo/gross)	27000/22000 ft
Landing dist. (solo/gross)	450/680 ft.

*40-minute reserve

LONG-EZ DOCUMENTATION

SECTION I - MANUFACTURING MANUAL - This is the complete education manual for composite materials and methods, also, the plans and construction manual for the entire Long-EZ except engine installation and landing-brake. The manual consists of a 180-page, bound 11" x 17" book plus 14 full size drawings. It includes many photos, over 800 drawings and 65,000 words. The builder is led step-by-step through the entire construction of the airplane, including electrical system, fuel system and finishing procedures. The manual identifies sources for all materials and all prefabricated components. A video tape is available covering all aspects of building the moldless fiberglass/foam sandwich construction. The tape covers the latest methods used to obtain the optimum weight, strongest fiberglass lay ups. This presentation will help both the first-time and experienced builder and attain quality aircraft workmanship.

SECTION II - ENGINE INSTALLATION - This is a set of drawings and construction for the complete engine installation, including mount, baffles, instrumentation, electricals, fuel, exhaust and induction systems, carb heat box and muff, cowling installation, prop and spinner.

OWNERS MANUAL - This is the required operations handbook and checklists, including normal and emergency operation, detailed flying qualities and performance charts, maintenance, maiden flight procedure, and pilot checkout, etc.

A video tape is also available which covers the weight and balance procedures, taxi tests and first flight.

LANDING BRAKE - Complete full size drawings for the landing brake device. This is the large drag plate that extends from the bottom of the fuselage for landing approach.

Check items desired.	Price, includes first class mail to U.S. & Canada	Overseas Airmail - U.S Funds
Rutan Aircraft Information Package - complete data and photos of all Rutan designs.	$ 8.00	$ 9.00
"Canard Pusher" newsletter Published quarterly. One year subscription. Approx. 10,000 words per issue.	6.75	8.75
Long-EZ plans. Section I	198.50	212.50
Section IIL Lycoming	21.50	23.50
Long-EZ Owners Manual	9.00	10.50

Long-EZ Landing Brake	10.00	11.00

6% Sales Tax, if Calif. order.

Newsletter not taxable.

The following are RAF-authorized distributors of Long-EZ materials and components. Contact the distributors at the addresses below for their and description of items.

ALL RAW MATERIALS AND PREFAB FIBERGLASS PARTS

Near Los Angeles
AIRCRAFT SPRUCE
201 W. Truslow, Box 424
Fullerton, CA 92632
(714) 870-7551
Catalog $4

Near St. Louis
WICKS AIRCRAFT
401 Pine Street
Highland, IL 62249
(618) 654-7447
Catalog $3

Prefab machine parts such as, control system parts and welded parts, fuel caps, engine mount, rudder pedals and exhaust systems.
KEN BROCK MANUFACTURING
11852 Western Avenue
Stanton, CA 90680
(714) 898-4366
Catalog $3

Main and nose gear, fuel strakes, fuselage bulkheads.
TASK RESEARCH INC.
848 East Santa Maria
Santa Paula, CA 93060
(805) 525-4545

Canopies are available from RUTAN AIRCRAFT.

RUTAN AIRCRAFT FACTORY INC.
BUILDING 13 airport
Mojave Calif 93501

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This amount of baggage fits nicely in the Long-EZ baggage areas. Baggage is accessible in-flight.

Three generations of EZs in formation. In foreground the newest - Long-EZ.

PHOTO OF SOLITAIRE OMITTED

THE CANARD PUSHER NO 40 Apr 84

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Back Issues	$1.50

If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 40. If you are building from 2nd Edition plans you must have newsletters 18 through 40. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 40. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 40. If you are building a Long-EZ you must have newsletters from 24 through 40. If you are building a Solitaire, you must have newsletters from 37 through 40.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF's 10th ANNIVERSARY!!
Canard Pusher #40. This means that RAF is 10 years old. For 10 years RAF has put out a newsletter every 3 months. During the 10 years since Burt founded RAF, he has put out unique aircraft designs for 12 different airplanes. Eleven of these were built and went through flight test programs here at RAF. In addition to these Burt has designed at least 4 other airplanes that have been built and flown. As everyone knows, Burt has branched out and formed his new company, Scaled Composites. At least two new designs have already come out of this company.

We, the employees of RAF are very proud of our Boss and friend, Burt Rutan. We are proud to work for him and proud of his and RAF's record over the last 10 years. We look forward to many more years of exciting, rewarding and innovative work at the leading edge of aviation technology. We're sure that our customers, whom we consider to be part of the family, feel the same way.

This is a list of the aircraft that were built or tested at RAF:

Model	Name	First Flight
27	VariViggen - Standard	1972
32	VariViggen - Special Wing	1975
31	Pre-prototype VariEze	1975
33	VariEze	1976
54	Quickie	1977
40	Defiant	1978
61	Long-EZ	1979
72	Grizzly	1981
73	Fairchild NGT - Twin Jet	1981
77	Solitaire	1982
76	Voyager	1984

Other designs that have flown:

35	Scissor Wing AD-1 (NASA)	1979
68	Amsoil Racer	1981
97	MicroLight (Lotus)	1983
115	POC Starship (Beech)	1983

"RAF'S SECRET BACK-ROOM PROJECT"
The existing absolute unrefueled distance record for aircraft was set over 24 years ago with a B-52 at a distance of about half way around the world. Since the advent of high-performance advanced composite materials, the goal of global non-refueled flight has been within reach. A global non-refueled flight has been called the last remaining major milestone for aviation's history.

In 1981 Burt designed a rather remarkable aircraft with a specific mission. The model 76 Voyager was optimized for long range and intended to shatter (even double) existing distance records.

Dick Rutan and Jeana Yeager then formed Voyager Aircraft Inc. (VAI) and planned to get this aircraft built and to achieve the goals of setting new distance records and to attempt the Round-the-World Flight.

In mid 1982, VAI and RAF agreed to a team plan where RAF and Burt would design, build and flight test the aircraft to prove its structure, flying qualities and performance. VAI would then equip it with special engines and props and the navigation systems required, and conduct the record flights.

Soon, after nearly two years work by a very small team, an awesome aircraft will emerge. Its fabrication has been done by some very hard work by a few dedicated people. RAF contracted Bruce Evans, an early VariEze builder/flyer. He has virtually lived with the project working continuous long hours on everything from tooling to structure and

systems. Jeana and Dick have also made a full-time commitment to the building process. Wedged in with the Solitaire development, the Voyager has been a primary task for all the people at RAF. Chuck Richey, a Scaled engineer and VariEze builder/flyer donated detail design work for the landing gear system.

Its prepreg carbon fiber tape/nomex honeycomb sandwich structure required us to build a special, large oven for bagged 250 degrees cure skins. Bruce and Dick travelled to Utah to use Hercules autoclaves to cure the carbon spars for the immense 100 foot plus wing.

The team was assisted by donations of materials and tooling help from Hercules, Aircraft Spruce, Wicks, Brock, Task Research, American Cyanamid and Hexcell. Ken Brock's donation included fabrication of the high-efficiency oleo landing gear assemblies. These units are works of art, they weigh only a couple dozen pounds each but will support an aircraft weighing as much as a business turboprop aircraft. Bruce Tifft has donated the interim propellers for the initial flight tests.

The Voyager is an imposing sight. Though designed to fly slow, its fuselage aerodynamically resembles a high speed racing aircraft. Like spacecraft, its structure is highly refined and optimized to support fuel weighing over 10 times the airframe weight.

Watch for announcements and photos in the aviation press, probably before Oshkosh this year. Its unusual design philosophy and details will be a guarded secret until this summer. This is being done to assure the this last-coveted goal in aviation will be owned not just by Americans, but by grass-roots "homebuilders".

RAF ACTIVITY
RAF has been involved in some work for the Army on an Army Long-EZ. We installed a Texas Instrument T.I.9100 Loran C, a King HSI and some special-mission sensors in a large external pod. We also converted their standard rudders to the new high performance rudders. This large rudder installation was very thoroughly tested not only by RAF, but by two Army test pilots. All agreed that they were an enormous improvement and no sign of any tendency to depart was observed by any of the three test pilots. We also made other changes and installations that are proprietary. It was a most interesting project to work on. Maybe if it shows up at Oshkosh it can park among the warbirds and get free gas!

Solitaires are being built by quite a few and we hear from them quite regularly. Michael Dilley has been doing an excellent job of supporting Solitaire builders. The prototype Solitaire is flown almost every Saturday and those that fly it still say it is more fun to fly

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than any of the other airplanes. Einar Enervoldson, a NASA test pilot wrote an article for Soaring magazine which is in the April '84 issue. The magazine has an excellent cover shot with several color and black and white photos in the article, all taken by photographer, Doug Shane.

DEFIANT

Fred Keller is just about done with his part of the Defiant plans and what an outstanding job he has done. Fred was down here at RAF for two weeks to make some of the final decisions on format etc. Fred took over 700 (yes, seven hundred!) black and white photos of his project throughout the construction. A great many of these will be in the plans with captions which will really help interpretation. Defiant plans will not be in the normal RAF format such as the VariEze, Long-EZ, or Solitaire plans. These plans will consist of about 80 pages 2 feet x 3 feet, of words, photos and lots and lots of detailed drawings and sketches. The emphasis is more on photos and drawings than on words.

We apologize to those who are patiently waiting for the delays, but we believe that the wait will be well worth it. We should have all of Fred's drawings in our hands within three weeks. Then the paste up begins to get them camera ready for the printers. The printer usually takes about 3 to 4 weeks. It won't be too long now! As Fred says, keep in mind that it is easier to build two airplanes than it is to write one set of plans!!

Burt reports that the prototype Defiant has 800 flight hours and in order to appreciate the fantastic utility of a Defiant you only have to follow one of it's trips.

For example, last week Burt and Rob Shirtzinger (a Scaled engineer) flew non-stop to Aspen, Colorado. Average cruise altitude was 15,500 feet. The last portion of the flight was above 17,500 feet to clear the clouds, turbulence and icing conditions (using portable oxygen of course). The descent into the beautiful Aspen area was exhilarating. The performance of the Defiant at this near 8000-foot altitude airport was excellent.

The return trip was relaxing even though done in darkness over some of the roughest, most remote terrain in the United States. Trip times were three plus twenty five to and three plus forty return, not bad for the 650 nautical mile distance. Fuel used was only about 50 gallons each way.

This type of utility is of course, unachievable with any production trim for less than a quarter of a million dollars!!

RAF is now accepting orders for the Defiant plans. Your check will be held and not cashed until the plans are ready to ship.

Visa/Mastercard Credit Cards
Seeing as RAF builds plastic airplanes we decided that maybe we should take plastic money! RAF is now set up to honor Visa or Mastercard orders for $10.00 or more. This was done due to popular demand.

PATCHES
Ever since RAF ran out of the airplane planform type patches, we have had constant requests for us to do that patch again. You will be pleased to know that the first shipment is due in a few weeks time. RAF will have available the VariEze, Long-EZ, Solitaire and Defiant plan form patches. The aircraft are in white on a blue background with a red border to match the "name" patches. The name patches are available in VariEze, VariViggen, Long-EZ, Defiant and Solitaire.

Aircraft patches are $3.00
Name patches are #1.50

California residents please add the 6 percent sales tax.

OSHKOSH 1984
RAF will be closed during Oshkosh this year. We will not be available for builder phone calls from Thursday 26 July through Thursday, 9 August. All the RAF personnel will be involved in flying and driving aircraft to Oshkosh.

Don't forget the VariEze Hospitality Club dinner will be held at Butch's Anchor Inn on Monday, 30 July. If you plan on being there you must purchase tickets ($12.00 each) before Oshkosh. Contact Don and Bernadette Shupe, 2531 College Lane, La Verne, CA 91750.

Burt's talks this year are as follows:
Defiant - 3:45 pm - Monday, 30 July
Long-EZ/Solitaire - 3:45 pm - Tuesday, 31 July.

RAF will also be closed over the Memorial Day weekend. We will be headed up to Watsonville, California for the flyin and the delicious strawberries and artichoke hearts!!

NEW RUDDERS FOR THE LONG-EZ
The plans for the new rudders for the Long-EZs have been very popular although there has been some confusion. We will try to clear up a few points.

First of all, these plans are strictly for Long-EZ. They absolutely do not apply to the VariEze or any other type aircraft. VariEze builder/flyers should be able to recall a mandatory change in CP 22, Page 8, that reduced the allowable rudder travel from the original plans call out of 3.5" to 2". This was because the rudder authority of a VariEze was powerful enough in some cases to depart the airplane. The VariEze is the last airplane that needs stronger rudders!

If you have not installed your comm antenna(s) in your winglet(s) on your Long-EZ and you would like to have the high performance rudders, do not install any antenna in the winglets until you have the plans for the new rudders in hand. If you are wanting to retrofit the new rudders to a Long-EZ that is already flying, or one that has the antenna already installed per CP 26, you will have to cut through the original antenna and install a new one forward of the new rudder hinge line. This is covered in the new rudder plans. We have made this modification now to 3 Long-EZs and in all 3 cases the old antenna is still under the glass skin, (cut through and disconnected) and the new antenna works very well. We have not been able to perceive any degradation in radio performance. In fact on two of the three, we seem to have improved range both transmitting and receiving!

The new rudders on the Long-EZ give at least twice the yaw authority of the original rudders and allow you to steer while taxiing at speeds as low as 25 to 30 knots without using the brakes. The main advantage of course is in a crosswind take off from a narrow runway. With the new rudders minimal braking is required for steering, so you can accelerate

to rotation speed more rapidly. You can rotate at your normal rotation speed of 50 to 60 knots (depending on cg) in any amount of crosswind up to 20 knots at 90 degrees and lift off in essentially the same distance as you would with no crosswind. Quite a few homebuilt Long-EZs have flown into RAF with the new rudders and every one so far has been pleased with them.

SAFE-T-POXY II

We have had a lot of requests for information on this material. RAF has been using it in our shop for over a year. We did some direct comparison tests of laminates using regular Safe-T-Poxy and Safe-T-Poxy II. The results of these tests verified the manufacturers claim that the new material was as good or slightly better in every respect from a structural standpoint. In addition to this, this epoxy is thinner (less viscous) and tends to wet out the glass more rapidly with less effort. It should therefore be easier to work with in a cooler environment.

The single biggest advantage is the reported lower likelihood of experiencing an allergic reaction from Safe-T-Poxy II, even compared with the regular Safe-T-Poxy. This is not an easy thing for us to test, since no one who has ever been employed at RAF has had an allergic reaction to any of the epoxies that we have used.

Our experience with the material has shown some advantages and some disadvantages. The opinions of the folk that work at RAF vary, but the general consensus is that it does wet out better, especially if the shop is cool. Safe-T-Poxy II has more tendency to "run out" or "bleed out" of a given layup, especially if that layup is not perfectly horizontal. On a vertical surface or even a sloping surface, run out is more of a problem than it is with regular Safe-T-Poxy. The worst complaint is a considerably shorter pot life, especially in a shop that is heated to the recommended 77 degrees F.

Safe-T-Poxy II in our experience starts to gel and become "stringy" in the cup in about half the time that this occurs with regular Safe-T-Poxy. Once out of the cup and on the part, this is not a problem. If this "stringyness" occurs in the cup, this batch must be thrown away, since it will not wet out the glass once this has happened.

In conclusion, we recommend that you try Safe-T-Poxy II, perhaps a small kit and see how you like it. See if it suits your individual work habits. Both Safe-T-Poxies are excellent structural materials and are suitable for building any of the Rutan composite designs. Both materials are also better than any other epoxy we know of for fuel compatibility.

LORAN C UPDATE

Contrary to our thoughts that Jim Wiers super Sport Aviation article on Loran-C installations in composite aircraft would eliminate questions on the subject, it has only created more questions!! Please be aware that RAF is not an avionics shop, our expertise lies in aerodynamics and composite structures. Until recently we had never even flown behind a Loran-C. When we worked on the Army Long-EZ, we installed a

T.I. 9100 Loran-C per the manufacturers instructions. This particular Loran is one of the best and most expensive available. It is also specifically designed for use in aircraft.

It worked perfectly parked on the ground, even in the hangar as long as the engine was not running. As soon as we started the engine, it dropped off the line. Apparently the electronic noise that runs around the electrical system in an aircraft that would normally be "damped" out or lost in the metal structure and skin (which is the ground), does not get lost in a composite airplane. The ground in the composite airplane in most cases, is only one piece of wire that runs the length of the aircraft from the negative battery terminal to the firewall.

What can be done about this? Get the ground plane (all the large metal parts) tied together electrically to form as large a ground plane as possible. This means, to attach pieces such as elevator torque tubes to each other and to the negative terminal of the battery. All of the wiring should run up and down each side of the fuselage inside either aluminum or copper tubes which will act as a shield for the wiring. The tubes should run from the battery negative terminal (or as close as practical, and then electrically bonded with a short piece of wiring) down the length of the fuselage and out through the firewall. On the aft side of the firewall, the tubes should be electrically bonded to the aluminum or stainless steel firewall. A length of automotive braided copper ground strap should go from the bolt that connects these tubes to the firewall, to a convenient bolt on the engine accessory case or oil pan. This will give you the largest practical ground plane you can get, short of installing Jim Wier's wires under the wing skin, which can only be done if the wing has not been skinned.

A recent innovation in Loran-C antennas is to buy an automotive windshield type antenna. This consists of a very thin wire centered on a piece of clear tape. This can be installed inside the top of the canopy, starting as far aft as possible and running down B. L. O, all the way to the forward edge of the plexiglass canopy. The Loran-C preamp must be mounted on the aft canopy frame, and the antenna wire should be connected directly to the preamp. The preamp will be connected to the Loran with a normal coax cable, RG-58 AU. This antenna is reported to work great and is the brain child of Phil Stotts of Western Avionics of Fresno, CA (209-255-4872). Phil is a clever guy when it comes to Loran-C installations and has quite a lot of experience with VariEzes and Long-EZs. If you are planning a Loran installation, give Phil a call.

VariEze builder/flyer, Wes Gardner is flying with the above antenna installed and reports that his MLX works like a charm. One strange fact is that if this auto windshield antenna is removed from the canopy and lowered into the fuselage, the signal will immediately become intermittent. Could it be that the glass is not as transparent to VLF as it is to VHF?

Of course it goes without saying that a noisy regulator or alternator will give you problems even if you follow the above suggestions to the letter. A good linear regulator such as Bill Bainbridge of B & C Specialty, Newton, KS. sells, will effectively eliminate this problem. Contact Bill at B & C Specialty, 518 Sunnyside Court, Newton, KS 67114.

RAF will continue to disseminate information on successful Loran-C installations. Obviously there are probably many ways to make a Loran-C work in an EZ. Those we have suggested are just a few.

On the Loran-C article in CP 39, page 2 we forgot to include Bill Butters address. Our Apologizes.

Bill Butters
1478 Urbandale
Florissant, MO 63031

TO STATIC LOAD OR NOT TO STATIC LOAD

RAF has been receiving more and more requests from builders who would like to static load their newly constructed VariEze or Long-EZ. We are concerned that many of these builders may not fully understand what a static load entails and what the consequences of an incorrectly done static load can be.

Anyone who absolutely insists on doing a static load, can obtain a copy of the load schedule from RAF. We strongly recommend that you have a qualified structural engineer present during the load tests. Perfectly good parts can easily be failed by poorly or incorrectly done static load tests. This has occurred to some of the builders from overseas. Unfortunately, for some of the countries, their equivalent to our FAA has a requirement for a static load to be done. We know of two builders who have had their wings (on completed aircraft) destroyed. Do not allow some government official to decide on a load schedule for your airplane. Write to RAF and get a copy of the correct load schedule.

Before you rush off and static load your brand new EZ, consider this. When you purchased your plans from RAF, you paid for the benefit of all the aerodynamic and structural design capability that Burt and RAF has. RAF does an extremely thorough job of structural analysis, as well as conducting any static load test deemed necessary by Burt. Once the airplane is flying and the flying qualities are to Burt's liking, the airplane is put through an extremely thorough flight test program. Prior to the prototype being built, the amount of testing of various materials to be used in the aircraft is unsurpassed.

We believe that if you build your aircraft structurally and aerodynamically in accordance with the plans, and you layup the correct number of plies of the appropriate glass, (no less, and certainly no more), in the correct orientation, and you do a reasonable job of wetting out the glass with the appropriate epoxy, you will have an airplane that is more than adequately strong enough.

HIGH TIME EZS INFORMATION REQUESTED

A number of VariEzes now have accumulated quite high flight hours, several in fact are over the 1000 hour mark. Some Long-EZs are reaching for the 1000 hour mark. We would like to request from these high time builder/pilots information regarding maintenance type

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work that may have been required over the past many hours. We are thinking particularly of possible problems relating to paint finish, tire and brake wear, nose gear retraction, nose wheel fork friction, damping, electrical, baffling, engine problems, etc., etc.

We would like to try to accumulate data and make it available to the rest of the builders, to possibly help them to avoid anything that may be preventable. We know of nothing right now that is of any concern and would simply like to set up a means of keeping track for the benefit of all our builders and flyers.

If you have something along the lines described above, please send a brief description of the problem to RAF.

Canopy Opening In Flight In An EZ
Ralph Gaither, an experienced naval pilot with over 26 years of experience in airplanes and a VariEze pilot/owner called the other day to let us know of a canopy opening that he had. First of all his canopy warning system was out of order, a micro switch had failed. (Don't laugh, this can happen to you!) Secondly it was a hot day in Arizona. The canopy was kept open while taxiing out to the runway. The canopy was locked, then the wind shifted necessitating a long taxi to another runway. The canopy was opened for better ventilation (you can see it coming, right?) To make a long story short, he had to quickly fit in between traffic for take off, his safety catch had somehow gotten bent and did not catch, so the canopy opened fully at between 200/300 feet AGL during the climb out. Ralph, kept his cool, he flew the airplane, maintaining the climb, left the throttle full up, reached with his left hand and grabbed the canopy rail. He pulled the canopy down and closed it on his wrist (not fully closed). He climbed out in this configuration until at 1000 feet AGL. He trimmed the airplane as best he could, and throttled back to fly level at a reasonably slow speed (100 to 110 knots would be best). Then he took his right hand off he stick and calmly locked the canopy and continued on his way. Ralph's canopy does not have the throw over stay that was shown in CP 30, page 8. Rather he has a simple retaining cable. He expressed the concern to us that he felt that the over-center type throw stay may have made it much more difficult to close the canopy in flight. We have given this some thought and we agree. It would be more difficult to close the canopy, but certainly not impossible. Anyone who flies an EZ with this type of stay, will know that it takes both hands for about a second to flick it over center and close it.

It is food for thought and we wanted to give the builder and flyers the benefit of Ralph's experience. We believe the throw over stays advantages out weigh its disadvantages. It is very light, it will hold your canopy open in a wind without allowing it to crash closed or open against the fuel tank. It does not impose the tremendous torsional loads through the canopy frame that the gas spring type canopy restrainers do.

Consider also that there has to be literally a triple failure before this would become a factor in flight.
1. The canopy warning system must have failed.
2. The safety catch has to fail.
3. The pilot must have a brain failure, or fails to comply with his or her checklist.

All three of the above have to occur before the throw over stay becomes a factor. We at RAF have elected to keep our throw over stays but we feel that each individual builder should make his or her own decision.

Incidentally, Ralph reported that the airplane was not at all difficult to fly, he easily maintained heading and continued his climb. The biggest thing to remember is to FLY THE AIRPLANE.

CAUTION - Unauthorized Prefab Parts For The Long-EZ
It has recently come to our attention that there are some prefabricated nose cones for Long-EZs, as well as other parts, such as fuel/baggage strakes, that are being misrepresented as being approved by RAF. The only RAF approved prefab Long-EZ parts, are manufactured by Task Research of Santa Paula, California. These parts are sold through Wicks, Aircraft Spruce and Task Research.

The prefab nose cone in particular is manufactured from non approved glass and polyester resin. It is not a sandwich construction, is heavy and would be difficult to incorporate safely into a Long-EZ. The nose section of a Long has to be able to support the loads taken by the nose gear. In order to do this safely, we believe the plans should be followed as closely as possible. The Long-EZ nose is not simply a fairing, it is a structural sandwich, composite design that should not be compromised.

LETTERS FROM THE BUILDERS
"Dear RAF,
After almost 500 hours in our Continental 0-200 powered VariEze, N13WM . We decided to give her a new heart. She made her first Lycoming 0-235 powered flight on the 16th of March, 1984. So far we are very pleased.

We were featured in an episode of "Blue Thunder", the TV series in February '84. N13WM and her identical twin N13MW played the part of the nasty drones.

After almost a year of frustration trying to make our MLX Loran-C work, and almost ready to give up on it, we read in CP 39 , Page 2 of Ray and Nova Cullen's success with their MLX, and decided to follow their advice. We contacted Phil Stotts of Western Avionics in Fresno (209)255-4872. He is definitely a whiz. With just a simple installation application of an auto windshield type antenna, our Loran-C works like a dream.

Sincerely,
Wes and Millie Gardner"

"Dear RAF,
The weather here in the northwest has been terrible, so I have not been flying much. The aircraft is a super flying machine and a compliment to Burt's designing and engineering skills. The only incident to report is an engine failure. Airplane fault? NO. Pilot stupidity? Yes. I was flying up the Columbia river gorge towards the Dalles at about 3,000 feet when I suddenly heard the ominous sound of nothing but air, and sudden deceleration,. You always think the worst in these kinds of situations, but since there were no loud noises, I figured that fuel starvation must be the problem. I checked the boost pump, it

was on. Mixture was rich, throttle was full open. All the time I was looking for a spot on the freeway below, thinking, 6 o'clock news, here I come. (I really did not want to break into show business in this manner) I then reached for the fuel valve (had to loosen my shoulder harness first) and switched tanks. As I was reaching for the starter, the engine roared into life. Music to my ears!! I added full power and climbed to 5,000 feet so that if it dare happen again, I would have a shot at the airport. All of this happened in a matter of seconds but, with absolute fear coursing through every cell of my body, it seemed like an eternity.

On the ground I checked the drain on the suspect tank and only a few drops dribbled out. Before take off I had assumed I had about 3 gallons in that tank. I had 5 gallons added to it. I took off on this tank and flew for about an hour at high power settings when the failure occurred.

Evidently there was little more than the 5 gallons when I took off. I am only thankful that it occurred with enough altitude to handle the situation, and that it ended up a learning experience and not a tragic one. Additionally thank goodness for the other tank!

Sincerely,
Dave Perrosino"

Editors note: If you do hear the sudden silence, always assume it is fuel related and switch tanks immediately., Check mixture rich, throttle open. The prop will continue to windmill if you were cruising along, so you do not need a starter. It will windmill down to 65 knots in fact.

ACCIDENTS AND INCIDENTS
A southern California VariEze was seriously damaged during a forced landing caused by the catastrophic failure of a home made kevlar prop. The pilot suffered a serious foot injury.

This propeller was reportedly designed and built by the pilot. The laminate consisted of multiple plies of kevlar layed up with room temperature cure epoxy, similar to that used to build the VariEze. The prop had a total running time of approximately 3 minutes when during the first take off, one blade failed completely near the hub.

Composite props may eventually be built that will be safe for us to use on our homebuilt airplanes, but we must caution builders that composite props require careful design and very, very thorough testing under controlled conditions. Propellers especially on a pusher, operate in a very stressful environment, the average homebuilder simply does not have the facilities at his or her disposal, necessary to tackle such a project.

EZ CLUBS
EZ Builders Of Florida - A very active group of builders put out an excellent newsletter that is published on a flexible bi-monthly basis. The main purpose is to aid in the construction and assimilation of

information on all Rutan designed aircraft, as well as other aircraft using the same type materials. A fee of $6.00 annually is requested to help cover mailing and printing costs. Anyone is welcome to subscribe, whether or not you are building an airplane. For more information, contact:

Contact: Jim Carlin
7282 Skyline Drive
Delray Beach, FL 33446
(305)498-8006 - nights
(305)585-1756 - days

Long-EZ Squadron I - Chino, California. This is an active Long-EZ builders only club. They put out a bi-monthly newsletter and have meetings once a month usually with a guest speaker. The purpose is to help each other during the building stages and to encourage as many as possible to complete their airplanes. They have a respectable record so far. Club membership is limited to 100. To qualify for membership you must have a set of Long-EZ plans and have a RAF issued serial number.

Contact: Robert Maetzold
2814 Associated Road #7
Fullerton, CA 92631

Long-EZ Squadron II - Santa Monica, California. This club is an offshoot of the Squadron I and has generally the same goals and requirements. Mike and Sally were the guests at last months meeting and thoroughly enjoyed the camaraderie of a group so dedicated to producing safe, high quality Long-EZs. In a hangar on the field, there are two flying Long-EZ's, while upstairs in the attic there are four more under construction. One of these is very nearly done, and should be an outstanding example. This group of four are called the "hole in the wall gang" and with good reason. They will have to cut a hole in the wall to remove their airplanes from this second story workshop!

Contact: David Orr,
2523 S. Bundy Drive,
Los Angeles, CA 90064

D.U.C.K.(S) - (Dayton United Canard Klub!) This club now has 43 members and are continuing to grow. They are presently assembling a photo roster to include a photo of each member and his or her project. This will be updated each six months. This club is not exclusive to a particular type, rather it caters to all canard, composite types.

Contact: Michael Zimmerman,
7313 Dabel Court
Dayton, OH 4549
(513)435-0882 - home
(513)434-6800 - work

SOLITAIRE CLUB

If you are building a Solitaire and are interested in forming a club, Bob Matheny from San Diego would like to hear from you. Bob is probably as far along as any Solitaire builder and would like to exchange information and share ideas.

Contact: Bob Matheny,
4452 Brindisi Street,
San Diego, CA 92107
(619)223-3745

FLY INS
Sun 'n Fun 1984. Due to other commitments, RAF was unable to make it to the flyin this year. Charlie Gray, Johnny Murphy and Herb Sanders filled in for us. Thanks a million guys, RAF is mighty lucky to have builder/flyers such as you to pinch hit for us and we appreciate it.

The following is a report from Charlie: "The weather for Sun 'n Fun was as good as 1983 was bad. Sunday to Sunday was almost all sun with only one afternoon and evening shower. The first day we had 5 or 6 EZs fly in. Each day we had a few more come in until about 20 Longs and EZs showed by the end of the week.

Monday I held the RAF forum for Mike and Burt. We had all seats filled and most of the talk was about Long-EZ. Herb Sanders gave a very interesting talk about his results with Loran-C and how to install antennas in the winglets. Johnny Murphy gave a talk on the coming Defiant. Lots of questions and answers. But 45 minutes is just not enough for me to get started talking about the Long-EZ.

Don Riley and I held bull sessions on the flight line on Sunday and Friday. These were enjoyed by all with lots of talk and information given and taken from the builders and flyers.

The annual EZ builders of Florida banquet had 65 members and friends on hand. Bob Dunham had made a cake for Ron and his wife for their 2nd Anniversary. The message was "Marriage with you is VariEze and full of Quickies and Long-EZ with nary a Defiant Word"!!

All in all Sun n' Fun was much better this year. We all missed the RAF bunch, but hope all that time was spent getting the drawings for Defiant plans ready.

O.K. get to work, build fast, fly safe and see you next year.
Charlie

Flash! Just heard we have a new EZ member, congratulations to Jim and Susan Carlin on the birth of their daughter. OK, Jim, now get back to work on your Long-EZ. C".

2nd Annual IVHC Flyin - Concord, New Hampshire. Saturday, June 23, 1984. This flyin is held in conjunction with the Concord Air Day and last year 10 EZs and 20 builders were on hand. Come on up and join the fun, lets see if we can double the EZ attendance. Two Long-EZs will perform a fly by routine. A Hyperbipe and a Christen Eagle II will go at it and Bob Hoover will fly his P51 and Shrike.

Free coffee and donuts, a drawing for a ride in a warbird, aircraft judging, bomb drops and spot landings will round out a day to remember.
Contact: Paul Adrien,
100 Franklin St.
Lawrence, MA 01840
(617)682-5656 - days
(617)635-3061 - evenings

Third Annual Flyin/Drive in - For RAF design builders in the Mid west will be held on May 19 from 10am to 4pm at Brookeridge Airpark

(private). We have put it a month later this year hoping for better weather this year. Like last year, the hosts (Talbot, Gutch, Steichen) will provide Brats and Soda for $1.50 per person, and people are requested to bring a salad or dessert if they can fit it in their EZ. Also bring anything of interest (parts, kids, games, video tapes, parts or supplies you don't want etc).

Brookeridge Airpark is 21 DME outbound on the Joliet VOR 050 radial on the Chicago sectional. 9-27 runway 2800 feet monitor 122.9. Driving location is sough of Downers Grove 1/4 mile north of Lemont road exit off I-55. (960 86th Street). The event/picnic will be held off the west end of 9-27 on private property. RSVP 312-985-6671.

Jackpot Fly In and EZ Race - Come to the extreme N.E. corner of Nevada, for a really special flyin over July 6, 7, and 8, 1984 weekend. The Jackpot airport has a new 6000 feet asphalt runway at an elevation of 5217 feet. Excellent camping facilities on grass, only 100 feet

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from tiedowns. Tennis courts, swimming pool, golf course, billiards, gambling and live entertainment. Cactus Pete's Resort Casino is close by and offers lodging (advance booking required).

Shirl Dickey has conceived of a race "The Jackpot 120", which was very popular last year and even features prize money put up by Cactus Pete's Casino. Ribbon cutting, spot landing contests and an awards banquet will make this year's event a memorable one.

Contact: Shirl Dickey
1646 Allegheny Drive
Murray, UT 84123
(801)974-7526 - days
(801)268-3360 - evenings

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.

MAN-XXHR Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.

DES Desired - strongly recommended but not requiring grounding of the aircraft.

OPT Optional - does not effect flight safety.

OBS Obsoleted by a later change.

MEO Minor error or omission.

VARIEZE - There have been no reported plans changes.

LONG-EZ PLANS CHANGES

LPC #117, Section IIL, Page 10.
The Lycoming #STD 619 washer should be replaced with an AN970-6 washer. The Lycoming washer has too large a hole allowing it to slip over the 1.84" long spacer. This allows the rubber bushings to be crushed more than they should be.

SOLITAIRE PLANS CHANGES

SPC-38
CP 39, Page 6, Solitaire plans change #33 called out a change in the hole diameter of the SRH-4 and SRH-8. Delete this plans change and change the center hole diameter from 1/4" to a #12 drill on the SRH-1 and SRH-9 as shown on Page 7-4 and 7-5. This change has been accomplished on the Brock part.

SPC-39
Section I, Page 2-2. Under washers, 8 each 18-2-9, change to 8 each 18-2-G. These are nicopress sleeves.

SPC-40
Section I, Page 10-1, Step III calls out the spoilflap drive tubes as 5/8 x .058 2024T3. Change this to 3/4 x .035 2024T3. Also change 24" 5/8 O.D. x .058 wall 2024T3 tubing to 24" 3/4 O.D. x .035 wall 2024T3 tubing on Page 2-2 materials call out under Spruce and Wicks. Change the call out on Page 10-2 Figure 11-3. Changing this tube diameter will require the drive tube to be set in the spoilflap slightly aft of where the 5/8 O.D. tube would sit. This is however acceptable because the rodends that screw into the SSF-6 can be adjusted slightly longer.

SPC-41
Section I, Page 10-2, Figure 11-6 and Page 10-3, Figure 11-7 calls out a 5/8 O.D. x .058 wall tube. Change this to 3/4 O.D. x .058 2024T3 as shown on Page A-23 detail B.

SPC-42
Section I, Page 9-4, first paragraph. Before the layup for the trailing edge foam core is layed up, it is necessary to install the SCS-111 in the aft face of the wing core. The position of this is shown on Page A-23. Round the top and bottom edge of the part to allow it to follow the contour of the foam after it is inset. Be certain the

hole layout fits the holes in the SCS-110 brackets. Install K-1000-3 nut plates on the back side, apply some silicone to the back of the nut plates to keep the micro out, sand both sides for bond and inset the part flush into the foam as shown on Page A-23 with micro. NOTE: The round over and nut plates will be on opposite sides to make a right and left hand part. Then proceed with the trailing edge foam layup.

SPC-43
Section I, Page 10-1, Step IV calls out to install the Avex pop rivets into the control tube. However the rivets will interfere with the SSF-9 as shown on Page A-21, detail D. So do not install the rivets now. Make a note on Page 14-3 spoilflap actuation, paragraph 3, to install the Avex pop rivets at this point.

The same problem exists on the aileron drive tubes as called out on Page 10-3, Step IX. Do not install these Avex pop rivets now, rather make a note on Page 14-2, paragraph 8 on the left column to install these after the SCS-212 insets are installed in the aileron drive tubes.

SPC-44
Section I, Page 10-1, Step II. Spoilflap bottom skin calls for 2 plies UND at +30 degrees and 2 plies UND -30 degrees to the T.E. Change this to 1 ply -30 degrees and 1 ply +30 degrees UND to the T.E.

SPC-45
Section I, Page A-24, View C-C and Page 14-1. Pitch and roll system. When installing the SCS-2, SP-1 and SP-2 assembly, this must be shifted to the right on View C-C for the SCS-208 to miss the LWP-R legwell side bulkhead. The SCS-208 must have a clear path from the SCS-2 to the SCS-102 walking beam. Check this before permanently installing the SP-1 and SP-2 control stick supports.

SPC-46
Section I, Page 6-1, Step IV. Installing the forward longerons. After the first sentence add "trim the longeron so that when it is clamped in place the 9.25 dimension is not compromised as shown". **SKETCH OMITTED**

CP40, Page 6

SPC-47
Section I, Page A-6. Legwell side bulkheads. Cut a hole through the LWP-L and LWP-R bulkheads both right and left at W.L.20 and F.S.51.25. This is 6" back along the W.L.20 line. Cut a 5" diameter hole with the center at this point. Also make two round covers from .020 2024T3 aluminum, 6" diameter as covers for these holes. These will be installed later with RTV silicone. The holes should not overlap the rudder pedals so there is no chance to catch the rudder peddles or cables on the edge of the hole. These holes will allow easier installation of the rudder pedals.

Oops! We forgot to include the following performance chart in the Solitaire's Owners Manual. Clip this (or photo copy it) and glue it into the manual permanently. Page 41, under "notes" would be a good place. **GRAPH OMITTED**

SOLITAIRE BUILDER HINTS

#8. Section I, Page A-5 shows a scale drawing of the Solitaire canard and elevators. There are numbers in circles with lines to various layups. These are the order in which the layups are done with #5 (not shown) being the elevator end ribs and the end ribs in the T.E. of the canard at B.L. 75.

#9. When building the canard templates, match each one to the drawing on Page A-5. We have found that the template H on Page A-11 varies from Page A-5. After cutting the template H out, lay it on the drawing on Page A-5 and remark the hinge line and rear shear web. All dimensions on the canard and elevator should match Page A-5 except the spar caps are exaggerated for clarity.

#10. Section I, Page 5-1. When installing the static port in the fuselage side, we found it simpler to cut a slot through the inside skin, remove the core at this point. You will be able to tell where this hole is on the outside by gently pressing on the outside skin. Mark the center of this slot on the outside skin. Bend the tube and seal the end as called out in the plans. Pot the tube in place with micro and cover with one ply of BID lapping 1" onto the inside skin.

#11. Casey at Task Research suggested the following idea for installing the longerons. This is different from the plans, but reportedly worked well. Instead of using a one piece, solid longeron, Casey laminated 3 pieces 1/4" x 3/4" spruce together using epoxy to join them. They were clamped into position in the fuselage and allowed to cure. Use grey tape on the inside of the fuselage as a release. After cure, remove the now curved longeron, trim and level the ends as required, then flox them in place per the plans.

BUILDER HINTS

VariEze and Long-EZ - If you ever experience what appears to be a brake failure, that is to say you hit the brake and it goes all the way down, don't just sit there!! Hit it again and if necessary several times and it will almost certainly be as good as ever. This had been a fairly common problem, and can be caused by several things. The first place to check is the clearance between the brake caliper and the wheel pant and/or the main gear strut. If the strut or wheel pant touches the caliper, this will cause the piston in the caliper to back away from the brake disk, and this will then necessitate several quick pumps on the brake to bring the piston back. Similarly, a disc that does run true can do the same thing. Do not just assume that your master cylinder is shot, do check it for signs of hydraulic fluid leaks, also check the elbow and fitting in the caliper for leaks. Don't forget to check fluid level in the master reservoir. Do not fly if you suspect a bad brake.

Another potential place to keep an eye on is the hole in the firewall where the rudder/brake cable goes through and connects to the CS15 bellcrank. Check and be sure that it is not possible for the nicopress sleeve on this cable to go into the hole and jam. If necessary enlarge these holes a little, or adjust the brake cable length to limit the travel so the nicopress sleeve does not get into the firewall.

Dick Kreidel has been using a new brake lining, a Cleveland part #66-56, which is a semi metallic material with good success. He reports equal brake effectiveness, but about three times the brake lining life. RAF is currently testing these linings and so far have not managed to wear them out, so cannot comment on the brake life.

VariEze and Long-EZ - Cooling vent door, installed easily in the little NACA scoop in the canopy frame. It is so simple and works so well, it is amazing. Designed by Gene Zabler, himself a VariEze builder/flyer, this little door can be installed in 10 minutes. You control it with one finger from completely shut to full open or anywhere in between. It eliminates the need for a foam plug and you can keep your hankie in your pocket when it rains. Gene will sell you one for $6.00 plus .50 for packaging and postage.

Contact: Gene Zabler,
48 Robin Hill Drive,
Racine, WI 53406

Long-EZ - Fuel/baggage strakes. If you are installing the Task Research prefabricated strakes, it is a good idea to delay cutting out the baggage holes in the fuselage sides, until you have the strakes in hand and fitted. Mark around them, measure inside this mark the thickness of the sandwich strake and cut along this new line. Do not attempt to install the fuel/baggage strakes unless the appropriate wing is bolted in place. It is nearly impossible to position the strake so it fairs nicely with the wing if you don't. You can do this one wing at a time if you are pressed for space.

Fitting the ribs/bulkheads to the inside of the top of the strake on prefab as well as homebuilt strakes. Install the ribs and bulkheads per the plans. Trial fit the top and sand the ribs and bulkhead down until the top of the strake fits well to the fuselage, centersection, wing root and leading edge of the bottom strake. There is no need to strive for a perfect fit on top of the ribs and bulkheads (this is difficult to do). Now stick a strip of grey tape inside the top of the strake to correspond with every rib and bulkhead in the tank/baggage area.

Pile flox on top of each rib and bulkhead generously, then set the top in place, cleco or clamp or grey tape it in its proper position and allow the flox to cure. Pop the top off, remove the grey tape release and sand the appropriate areas for bonding. Trim the flow overspill on each side of each rib and bulkhead, sand the top of the flox (which is now a perfect match to your strake top). Smear a thin, wet flox coat on the top of each bulkhead and rib, don't forget the leading edge and along the fuselage, then put the top on for the final time. Clamp, cleco and or grey tape it in position for a full cure.

This method gives you a perfect fit between the ribs/bulkheads and fuel tank top. This gives better support for when people sit on your strake while climbing in and out of the airplane and of course it is much stronger.

Do yourself a favour and paint a generous, wet, full coat of Safe-T-Poxy everywhere inside the fuel tank, paying particular attention to the fuselage sides and the forward face of the centersection spar before you close the tank. This will eliminate the frustration of fuel tank leaks.

NEW EZ FIRST FLIGHTS

We have not reported first flight name and types since CP 35. The following list are those that we know of who have made a first flight in their EZ since CP 35. If you know of anyone who should be on our list, please send us his or her name, address and date of first flight.

Irene "Mom" Rutan as most of you know, has kept a historic record of all known Rutan type aircraft. She would very much appreciate receiving a card and if possible a photo of your aircraft if you are flying. She has a really interesting photo album dating back to Burt's first flight of the VariViggen. She has names, addresses, first flight dates and photos of virtually every Rutan type aircraft that has flown. She would like to keep this record as accurate and as up to date as possible. So, please send in the information on your aircraft and be included in Mom's photo album.

Mrs. Irene Rutan,
8526 Calmada,
Whittier, CA 90605

VARIEZES

D. ADMAS	N65DV	R. MOSS	N262D
V. ATKINSON	N3LZ	R. MUCHA	N50ME
J. CARROLL	N?	G. NICHOLAS	N15GN
J. COX	D66DC	M. PUPPI	I-PINA
H. DAVIS	N3262D	H. ROBBINS	N83HR
L. GLASER	N999TT	R. ROYSE	N8508H
L. GODSEY	N57LG	W. SCHWEBER	N8517X
R. JOHNSON	N84EZ	G. STILLWAGON	N798EZ
S. KELLY	N529SK	M. TILLIA	N3248T
A. S. KNOWLES	G-BIMX	A. TOWNSEND	N40TS
E. LAUGHLIN	N4ZE	E. WALLWORK	C-GSPR
P. MILLET	N930L	G. ZABLER	N3793X
D. MOSKWA	N60HZ		

LONG-EZS

AERO-TECK	N36MX	J. BACH	N82TJ
C. BAKER	N3223P	G. BEST	N?
B. BOLTON	C-GFBB	J. BRANDT	N103JB
K. BRODRESKIFT	LN-HPB	K. CHRISTENSEN	OY-CMT
R. CORLEY	N82CD	P. CORNELIUS	N139PC
A. DIERKSEN	N?	D. DOMEIER	N26JD
D. ESH	N98CD	T. EVANS	N?
FERRIS/JOHNSON	N34JR	C. GRAY (#2)	N211LE
W. GUSTAFSON	N329W	S. HALE	N353H
K. HANSEN	N31AK	W. HARE	N262E
W. HINCKLEY	N55L2	M. HINSON	N160EZ
J. HOPELAIN	N9JB	R. HULTEN	N82KL
I. HUSA	N143EZ	N. JOHNSON	N613NC

G. KELLEY	N3260K	D. KREIDEL	N888EZ
H. McCLANAHAN	N3260T	A. McCUMBER	N407MN
S. OLESEN	N460LZ	D. PETROSINO	N1391W
J. PIERCE	N67JD	R. POYNER	N89PC
R. PUGH	N38EZ	W. PULLEN	N30WP
M. REILLY	N280EZ	D. RIEHM	N93JD
D. ROGERS	N25R	D. RONNEBERG	N515DR
G.&J. SABO	N20GJ	G. SCOTT	N468DS
L. SCOTT	N6NG	R. ST. CLAIR	N234SC
S. STIBER	N954LE	J. STITT	N82ST
P. SUPAN	N83PJ	B. TIFFT	N115EZ
R. VAN BALDEREN	N51EV	R. WHITE	N38AR
T. WILLIAMS	N8EZ	B. WOLD	N68BW
J. YASECKO	N303Y		

DEFIANTS FLYING!!

BURT RUTAN	N78RA	FRED KELLER	N39199

SHOPPING

Radio Systems Technology has recently put out their 10th Anniversary issue of their kit avionics catalog. This is a very worthwhile catalog and has many items of interest to EZ builders. Most of you will be familiar with Jim Weir, founder of RST. He is the designer of all of the buried antennas that we use with such success on our EZs. He has also written several excellent articles on the subject, that have been published in Sport Aviation. RST is located on the Grass Valley airport, Grass Valley, California. For more information or to receive the new catalog,

Contact: Radio Systems Technology,
13281 Grass Valley Ave,
Grass Valley, CA 95945
(916)272-2203

A variometer in your EZ. This is not as silly as it may sound. Especially if your live or fly in or around mountains, or high density altitude airports. Sailplane pilots are very aware of the benefits that are derived from a variometer. EZ flyers can get very helpful information from a vario. In simple terms, a vario is a very sensitive rate of climb. We have been testing a couple of Ball variometers, one in the Solitaire and one in the Long-EZ and have found them to be excellent. Ball makes a large variety of varios, some of them incredibly complex and sensitive. The one we tested is the simplest ones Ball makes. A 2 1/4" Ball model 601 which has a range of zero to 1000 feet and the other a 3 1/8" Ball model 501 with a zero to 1500 feet range. The rather low range gives greater sensitivity in the low rate of climb area, when you most need it while climbing in the vicinity of a mountain range. You will get positive information as to whether you will make it over the ridge or whether you should circle to climb. With practice you will find you can really take advantage of thermal lift or even wave lift. You can save gas by throttling back in strong lift and still maintain your ground speed. Try it, you will be pleasantly surprised.

Contact: Ball Variometers Inc.
5735 Arapahoe Ave,
Boulder, CO 80303

(303)449-2135

GREAT AMERICAN PROPELLER CO
Mike and Sally flew over to San Louis Obispo on the west coast where they met with the guys from the Great American Company. Mike tested two of their props on his Long-EZ, N26MS. Mike's Long-EZ has the high compression pistons installed (9.75:1) so it is a 125hp Lycoming O-235 now and Fred Griffith of Great American had designed and built a prop specifically for this engine/airframe combination. Although both props were good, one was the best Mike had flown. This prop, a 62x64 was carved from a Canadian hard rock maple blank. This blank is glued up using about 30 thin plies of wood, bonded under high pressure using Resorcinol glue. The prop looks very attractive with all the thin laminations joined with the dark resorcinol glue. After the prop is carved to shape and balanced, it has 70 percent of its blades wrapped in Kevlar. This is a time consuming process and each prop takes 11 days to go from start to finish.

The Great American Propeller Company was started in 1977 mainly building decorative clock propellers. Later they got into building props for homebuilts. In July 1983, the owner sold the company to three of his employees, Fred Griffiths, Kevin Ruediger and Bert Ruediger. These guys have worked hard to come up with a really excellent product and are justifiably proud of their product. Attention to detail is the watch word, the props are checked and rechecked for balance. The bolt holes are reamed a few thousandths oversize to that you can slide the prop bolts through easily with your hand.

Great American is concerned about the care that is give to wooden props. They believe, and RAF agrees with them, that it pays dividends to preserve and protect your prop. If it gets damaged by gravel or a rock, repair it and seal the wood. A properly cared for wood prop should provide many years of safe flying. For this reason Great American has a repair and refinishing service. They will refinish a wood prop and balance it for $49.95. They will do a complete rebuild, strip to bare wood, repair minor damage, refinish and balance (provided the basic prop is sound) and issue a new warranty on any of their props for $99.50. In addition to this Great American keeps a loaner Long-EZ prop, 62x62. They will ship it to anyone who needs a prop to get them home, provided the recipient pays the shipping both ways. This is a great service and could really be a boon to someone unfortunate enough to break a prop away from home. For more information, contact:

Great American Propellers,
11180 Pike Lane, #5
Oceano, CA 93445
(805)481-9054

PAUL PROUT'S NEW EZ FUEL GAUGE
Mike and Sally recently installed a pair of these gauges in their Long-EZ, N26MS. The installation was straight forward and the instructions supplied were easy to follow. The installation took two days mainly due to cure times on the epoxy. They look neat and best of all, work great. The fuel is clearly visible. Thanks to a soft red light in the

base of the gauge, the fuel is visible at night. Mike says that the most desirable thing about these fuel gauges is the fact that when you get down to approximately 30 minutes of fuel on either side, you get a low level warning light on the panel. No more inadvertently running out of fuel on one side. Now the light comes on and you have the choice of switching tanks or going to an airport. Best of all, you can still clearly see how much fuel you have, even with the low level light on. This feature makes these gauges highly desirable and greatly enhances the safety of you EZ. For more information contact:

Paul Prout,
4039 Olive Point Place,
Claremont, CA 91711
(714)621-0060

The following is from Byron McKean, a VariEze builder/flyer from Texas and the person primarily responsible for adapting the automotive compucruise fuel flow computers to our EZs in the form of the Compuflight. Byron has done a superb job of preparing, marketing and servicing these very useful instruments for all of us, but now, unfortunately he finds himself unable to continue with this important program. If anyone is interested in getting involved in a program like this, please get in touch with Byron.

McKean Systems Inc.
Rt 1, Box 429 B
McQueeney, TX 78123
(512)557-6575

"The CompuFlight computer system that I have supplied to homebuilders for the past fourteen months has been very popular and I feel should continue to be available. However, I am unable to continue to furnish the system. What started out as a hobby, quickly grew into a small business that requires more time than I have available, so I am looking for someone who is interested in taking it over.

The CompuFlight very accurately measures fuel flow and increases the accuracy and consistency of mixture leaning. In addition it contains a quartz clock, alarm, elapsed time, battery voltage, inside and outside temperature in both Celsius and Fahrenheit, plus when you enter your calculated ground speed, all time, distance, and fuel requirements are available to you continually. All this for a very reasonable price.

Anyone interested in operating their own business, increasing their income, and being able to deduct as a business expense much of your shop, office, and flying expenses, please contact me.

Until someone takes over, there are no more CompuFlight Units available as I am completely sold out. I will continue to service those I have sold and answer questions. I will also keep a list of those interested in purchasing an individual unit and pass along those names to the new supplier.
Thanks,
Byron".

FOR SALE
Lycoming O-235-C2C, 2000 hours total time, zero since major. Complete with logs, carb, mags, starter, alternator, fuel pump and vacuum pump.
Contact: Doug Shane

(805)824-4680 Evenings.

Lycoming O-255-L2C, 798 hours total time, complete with logs. Best offer. After 6:00 pm, no collect calls.

Contact: Paul Sticker
703 E Sunrise
Roswell, NM 88201
(505)623-5769

Continental O-200B (for pushers), factory brand new, with logs, generator and starter.

Contact: John Ring,
63 Main Street, Box 188,
Easthampton, MA 01027
(413)527-5835

Continental O-200A, 2927 total time, 1839 since major. $2000

Contact: Jim Carraway
P.O. Box 4163
San Rafael, CA 94903
(415)479-3668

24 volt starter and alternator for O-235-L2C. 200 hours total time on each. Both for $250.00 or $150.00 each.

Contact: Tim Crawford
(205)767-3493

Original VariEze main gear strut and nose gear strut. $170.00 for both.

Contact: James F. Jansa,
2 Rue de le Roi,
Ft Walton Beach, FL, 32548
(904)862-6806

Original VariEze main and nose gear struts and some other VariEze parts.

Contact: G. Brotherson,
2224 N. Demirit
Mesa, AZ 85205
(602)985-3241

Sensenich prop for VariEze - 58 x 69

Contact: Klaus Zavier
P.O. Box 115
Rhododenron, OR 97049
(503)622-4011

Electric gyro instruments, TSO'd, factory new and warranteed. 3 1/8" case. 14 V or 28 V, lighted

3400 attitude indicator - $645.00
4305 Directional gyro - $645.00

Contact: Shirl Dickey
1646 Allegheny Drive
Salt Lake City, UT 84123
(801)268-3360 - evenings.

Stainless muffler/exhaust system by Flight Research for O-200 VariEze. Integral heat muff, never used, cost $325, sell for $195.00.

Contact: Phil Wimberly,
1926 Pinehurst,
Los Angeles, CA 90068

Accessory case for Lycoming O-235-L2C, machined to accept a mechanical fuel pump.

Contact: Pete Simmons,
(203)535-2040

Continental O-200, zero time, disassembled, includes mags, VariEze Sanders exhaust system, oil separator system, engine mount, etc.

Contact: Wes Gardner,
1310 Garden Street
Redlands, CA 92373
(714)792-1565

Wes also sells oil separators for Continental O-200 as well as Lycoming O-235, lifetime foam air filters, fuel sight gauges and fuel caps.

WANTED

1 pair of original VariEze fuel strakes.

Contact: John Nelson
(801)571-0184 - evenings
(801)566-4655 - work

VARIVIGGEN NEWS

Since the last newsletter we have heard from only two builders. We have not heard from any Viggen flyers. Dennis Jacobs, serial number 486, wrote a most interesting progress report on his project and mailed to the members of the VariViggen Club. This is the way to keep up your enthusiasm for your project and we encourage each member to write up a report.

George Craig stopped by at RAF recently and he reports good progress on his Viggen. George is working on the canopy now.

Mike and Sally's Viggen N27MS has been flying a little more than usual recently, proficiency, annual inspection, etc. and it is performing as good as ever.

A poem by Debbie Pearsall.

Those awesome boxes all came in on 18 wheels that day. I hardly knew just what to think or just how long they'd stay. As each revealed it's contents of epoxy, foam and all, it seemed the lot was endless - - - it soon was wall to wall.

The task at hand was hardly known, yet he was surely ready. At that time it was hard to grasp, he'd still be working steady. The endless hours of reading prints and diagrams that blur were long and sometimes longer 'cause he knew he must be sure.

And I stepped in to help sometimes, when 2 hands weren't enough. The hot wire cutter moved with ease, though sometimes it was rough. I stirred and mixed epoxy and helped with fiberglass. I even helped to flip the plane , out front amidst the grass.

The living rooms not art nouveau, right now its art "de plane" At this time, gracing one full wall, not one, but 2 wings span. Our Heather's beds been covered, since that first shipment came. And Eric's too, from time to time, has looked about the same.

Now free times always taken up; he's always working steady. First the canard and then one wing and finally 2 are ready. Each finished step draws closer still that ever reaching goal. And that is usually all it takes to keep him on a roll.

I stand inside the doorway and look out past the piles. I think about how far we've come, first inches, then in miles. I realize that love is not just saying "I love you". Its letting someone that you love do what they want to do.

He soon will see the end of what he' striving for each day. And sometimes I will back him up and sometimes I will pray. That when that first day comes and he goes reaching for the clouds. He'll soar among the eagles and feel extremely proud.

VOYAGER
Around the World, Non-stop, Non-refueled.

The VOYAGER is in its final stage of construction and with some last minute systems work, it will be ready to take to the air this summer. As this 100 foot plus wing flying machine takes shape on the hangar floor, it is indeed a sight to behold. We are honored to know that the Smithsonian's National Air and Space Museum (NASM) has requested the aircraft be added to their prestigious collection along with the Wright Brothers, Lindbergh, Wiley Post, Amelia Earhart and so many others.

We have had a lot of help from people, who like us, have been caught up with the concept of world flight on "one tank of gas", and who have so generously contributed their time, effort, materials, hardware and moral support to the project.

We have also had many requests from individuals to be a part of the VOYAGER project. I wish we could put all of you to work sanding on the aircraft (its big!!!), but we can't. So far, we have kept the project somewhat on the grass-roots level. To allow a wider participation in the VOYAGER project, we are considering establishing a V.I.P. Club (VOYAGER's Impressive People). Contribution levels would range from placing your name in the VOYAGER log books (which will be enshrined in NASM), to invitations to attend special events, to autographing the aircraft itself. If you would be interested in helping through this type of membership, let us know. If the response is encouraging, we will proceed. Strong V.I.P. participation may allow the grass-roots effort to complete the entire VOYAGER project.

This is the last great milestone in the history of atmospheric flight. We would very much like to share this flying adventure with you.

Your VOYAGER Pilots
Dick Rutan and Jeana Yeager.

VIP CONTRIBUTION CARD OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

They call themselves "the hole in wall gang". Reason is the shop is in an attic and there will be a "hole in wall".

Randy Pflanzer's project coming along. What amazes us, is how super clean your shop is Randy.

Mr. Vigaire's project in France. We have quite a few builder/flyers in Europe.

Pat Krause stippling away at her Long. Pat is also putting together the RST radios.

Michael Zimmerman's super VariEze.

The first Long-EZ to fly in Germany belongs to Roland Heier. What beautiful countryside to fly over.

What a neat sight! 9 VariEzes and 1 Long-EZ at a flyin at Annemasse, France.

DEFIANT
HOMEBUILT
FOUR-PLACE
TWIN

Introduction
For some time you have been reading about the four place, push pull twin engine Defiant. After five years of enjoying a "one of a kind" aircraft, Burt Rutan has made the decision to release Defiant drawings to the homebuilder. In late 1981 Burt contacted Fred Keller of Anchorage, Alaska and asked if Fred would be interested in building a Defiant and keeping a complete log with updated drawings and photographs as he was building. Fred agreed and at the EAA convention in Oshkosh 1983, Fred's Defiant was on display. Some changes have been made to the original aircraft such as, an increase in span on both main wings and canard and a revised aileron for lighter control forces. The back seat folds forward for a `station wagon' effect that allows two people to use the baggage area for sleeping. The canopy opening has been improved for easier entry. The fuselage has been changed to allow more head room for the back seat passengers.

Fred Keller is now completing the detailed plans for the Defiant. These will be available from RAF in March 1984. The builder support

will be from Fred for plans interpretation, and from RAF for general `how to' on the construction.

Description
The Defiant is a four place, canard-type twin with two 4 cylinder Lycoming engines. Engine power can be 150, 160 or 180 horsepower per engine. It's canard configuration provides several important benefits as compared to conventional twins; (1) Packaging is considerably more efficient - it has a standard-size cabin in an airframe whose whetted area is only 60% that of a conventional light twin. (2) The smaller airframe also has reduced structural load paths allowing a structure much lighter than a conventional twin while having better durability and a higher `g' capability. (3) The tandem wings allow natural aerodynamic angle-of-attack limiting, thus, the airplane is stall resistant. (4) The tandem wings, using winglets for directional stability provide a 30% reduction in induced drag compared to a conventional aircraft with the same span loading. (5) Flight control systems are simpler and lighter. Elevators are only two feet from the control sticks and they provide a flap effect without having separate flaps, thus, at low speed the canard has a deflected full span slotted flap, yet the pilot has no flap control to adjust.

The rudder is only one foot from the pilot's rudder pedals. It is designed to provide control, yet have no effect on stability. Ailerons on the aft wing are controlled from their inboard end such that the entire wing and vertical fin assembly is built without any moving parts.

The small chord elevators and ailerons allow control forces compatible with a side-arm control stick. This allows more precise, less fatiguing control and provides improved use of primary instrument panel space.

Instead of the complex electrical system with one buss and battery tied to two alternators, the Defiant has two simple separate electrical systems, each with its own battery and alternator. IFR avionics are split to both systems so that no single failure can effect essential equipment. Both engines can be started simultaneously. The two systems can be tied together to run all equipment from one alternator in the event of a failure. Also, a low battery can be charged by the other engine without ground electrical equipment. Thus, the electricals are much like conventional fuel systems, i.e., completely independent but with "crossfeed" available in an emergency.

The fuel system consists of a 58-gallon tank with a large sump for each engine. The two systems are independent and require no pilot action for normal operations. Crossfeed is available. The sumps are accurately gauged and are equipped with low level warnings, such that when 45 minutes fuel remain the pilot not only has a warning light, but has a gauge that moves full scale for the last 45 minutes fuel. He can then intelligently plan his options when fuel is low, knowing quantity to within 1/3 gallon of fuel. The last one half gallon of fuel can be used in all normal attitudes. While appearing small outside, the Defiant is quite roomy inside. It has a cockpit width at the elbows of 46 inches (43 inches at rear seats). Knee and leg room for the backseats is a full eight inches more than current light twins. The Defiant has a large baggage area aft of the back seat and even larger

if the back seat is layed flat. Two six foot people could use this area to sleep in. The unique semi-supine seats provide a significant advantage in comfort over conventional seats. With a conventional seat, the upright pilot carries all his weight on the buttocks and small portion of the thigh. The Defiant's seat is reclined a full seven degrees more and armrests and headrests are provided for all seats. Thus the body weight is distributed over the lumbar, forearms, thighs and head, rather than being concentrated in the tailbone area. In general, a person who normally finds himself fatigued after a two to three hour flight, will be comfortable even twice that long in a well supported reclining seat.

The side arm controller and throttle system places the pilot's arm in a more natural position while flying and frees his lap area so he can use an airline type lunch tray for maps, approach plates, computers or lunch. Space efficiency and panel visibility is considerably increased when the control wheels are eliminated.

The aircraft is very basic in its systems. It will never require maintenance nor have an AD issued on its flaps, retractable main gear, cowl flaps, governors, hydraulic system, oleos, stall warning, nor emergency gear extension system, since these were eliminated in the basic design. The remaining systems (flight controls, power plant installation, electrical system, fuel system, etc) are all very basic and simple compared to the conventional light twin. This saves weight, reduces maintenance and increases availability and reliability.

Visibility, particularly in the pattern, is superior to current light twins. The canard wing is at approximately the same height as the nacelles on a Seneca II. Forward downward visibility is adequate over the canard during normal climb, approach and landing flare. Absence of a wing above or below the cockpit area results in a welcome improvement in visibility over conventional aircraft.

Flying Qualities
Flying qualities are conventional with the following exceptions: (1) Spiral stability is positive and speed stability is high, such that the aircraft flies "hands off" indefinitely once trimmed, even in turbulence. (2) There are no pitch or roll trim changes due to configuration or power. Once trimmed at approach speed it will hold that speed hands off during power changes and landing gear extension. The airplane is very stiff in yaw with high damping. Yaw oscillations damp in one to two cycles after a side slip release, as compared to three to six cycles for a conventional light twin. Roll rate is excellent. Adverse yaw is low enough that all normal maneuvering can be done with "feet-off-pedals" resulting in less than one-half-ball yaw excursions.

The Defiant is a very stable IFR platform with a very solid "big airplane" feel. It holds a desired approach speed with less attention than a conventional light twin.

Performance

In general, simplified systems means reduced performance. Not true for the Defiant. Overall performance and efficiency is significantly better than conventional light twins. Data discussed below are for 160 BHP engines. Time-to-climb to 12,000 feet is 10.3 minutes with full fuel and four adults and 7.7 minutes with two adults and 400 nm fuel. At maximum cruise speed of 184 knots (75% power), total fuel flow is only 17.8 gal/hr giving a 1.74 nm/lb economy and a range of 1044 nm with reserves. At 55% power (168 knots) total fuel flow is 13.9 gal/hr giving 2.00 nm/lb economy and a range of 1208 nm with reserves. At low cruise (40% power, 150 knots) range can be stretched to over 1300 nm with reserves. At equal loading and speeds, Defiant gets over 50% more miles per gallon than a conventional light twin! Holding capability is also impressive. At medium weight Defiant can remain aloft on only 40 thrust horse power (64 brake hp) for a maximum endurance of over 14 hours. The excellent two-engine climb capability allows cruise altitudes as high as 18,000 feet with 4 adults and full fuel. The prototype has climbed above 28,000 feet at light weight, single place. This climb capability is far in excess of similarly equipped light aircraft. (Fixed pitch prop and no turbocharger).

Single Engine Capability
In contrast to all other light twins, in which after engine failure a many-step procedure must be accurately followed during which aircraft control and airspeed control are critical, the Defiant makes no demands on the pilot to follow procedures. He can even use any excess airspeed over the minimum full-aft-stick speed to zoom over an obstacle. Once over the obstacle he can maintain aft stick and climb away (single engine) or accelerate without altitude loss to best climb speed. This unique capability is best shown by comparing the Defiant's takeoff profile with that of a conventional light twin (figure I). Both airplanes are at maximum gross weight. Both aircraft experience failure of the critical engine at 10 foot height. Neither aircraft can land and stop in the remaining runway, so they must continue the take off. The conventional twin pilot must immediately do the following: (1) raise gear (2) identify failed engine (3) retard throttle on failed engine (4) cutoff mixture on failed engine, (5) feather failed engine, (6) bank five degrees toward operative engine, (7) carefully raise flaps, (8) Maintain 82 KIAS to 50 foot altitude. After 50 feet (accel-go procedure) he accels to best angle of climb speed (95 knots) and thus, does the best he can do to clear any obstacles. Height-distance profile for this is shown as the lower line in Figure I. Note that even though his eventual climb gradient is adequate (193 feet per nautical mile) the 310 is nearly 4500 feet from brake release before reaching the 50 foot height, and that unless airspeed control and procedures are accurate he will likely crash during this climb segment.

The 310 is one of the best light twins to perform this profile. The "light-light" twin types will either have less performance or will strike the ground during segment A.

The other lines on Figure 1 represent the performance obtained by the Defiant for several conditions. The lower lines are obtained if the pilot elects to fly at the best single engine rate-of-climb speed. Note that if the pilot does nothing but maintain airspeed he will clear the 50-ft obstacle at 3300 feet, even with the gear down.

FIGURE 1 OMITTED

The upper lines on Figure 1 indicate an even more interesting capability of the Defiant. Suppose a tall obstacle exists at the end of the runway. The Defiant pilot can pull back the stick to zoom over the obstacle, even slowing to his minimum speed of 65 knots. After clearing the obstacle he can merely hold the stick aft and safely climb away even if he leaves the gear down (no procedure). If any conventional light twin attempts this, an accident will result, since, they cannot climb when near min control speed or stall speed. If desired, a standard rate turn can be initiated following an engine failure during lift off at gross weight.

Specifications and Performance
(with 160 BHP engines, fixed Props).

Engines (2)	Lycoming 0-320
Seats	4
Basic Empty Weight	1600 lb.
Equipped Empty Weight	1680 lb.
Equipped useful Load	1270 lb.
Gross Weight	2950 lb.
Fuel Capacity	115 gallons
Span	31.4 feet
Wing Area	133 square feet
Wing Loading	22.2 lb/square feet
Power Loading	9.2 lbs/hp
Payload with full fuel	660 lbs.
Max Cruise (70%)	184 knots
Fuel flow at max cruise	17.8 gph.
Range at max cruise (45 min reserve)	1044 nm
Economy Cruise (55%)	168 knots
Fuel flow at economy cruise	13.9 gph.
Range at economy cruise (45 min reserve)	1208 nm
Climb Rate (2950 lbs)	1500 fpm
Climb Rate (2220 lbs)	1900 fpm
Single Engine climb (2950 lb)	310 fpm
Single engine service ceiling (2950 lb)	6500 ft.
Single Engine Climb (2200 lb)	550 fpm
Stall Speed (2950 lb)	64 knots
Stall Speed (2200 lb)	58 knots

Cost and Time to Build the Defiant
The cost of the materials list has not been completed at this time, but we estimate the cost of building the Defiant will be approximately "two Long-EZs", between $20,000 and $30,000. Remember that avionics can cost you as little as $1000 or as much as you wish to pay.

Time to build the Defiant, again will be "two Long-EZs" as it is the same type of construction, just more. A competent builder can build a Defiant in as little as 2000 man hours. Until the plans are completed, it is difficult to say how many of the parts will be available prefabricated and this would make a difference to the time to build.

	U.S.A.	Overseas
Canard Pusher Newsletter	$ 6.75	$ 8.75

Defiant Plans - Section I $490.00 $510.00

Defiant Engine Installation . . . .not available at this time.

Defiant Owners Manual . . . . . .not available at this time.

THE CANARD PUSHER NO 41 JULY 84

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 41. If you are building from 2nd Edition plans you must have newsletters 18 through 41. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 41. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 41. If you are building a Long-EZ you must have newsletters from 24 through 41. If you are building a Solitaire, you must have newsletters from 37 through 41.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
RAF has been heavily involved in getting the Voyager ready for its first flight and the followup test flights. We have also been working on the Solitaire engine installation and of course the "big one", the Defiant plans. In our 'spare' time we have been testing the John Roncz designed canard for the Long-EZ. This canard has been installed on Mike's and Sally's Long-EZ and has been flown in seven different configurations. It shows a lot of promise, particularly when it comes to rain trim change. We will have more information at Oshkosh, since we are currently in flight test.

DEFIANT
The plans were completed and delivered to the printer on July 3rd. We are expecting to receive them back about the 22nd of July. We will mail out all plans that are on order as soon as we receive them and we will have Defiant plans available at Oshkosh.

Fred did all of the drawings for the Defiant plans and they are excellent. The plans are something of a departure from tradition for RAF. Not only were they done by someone other than us here at RAF, but the format we decided on is new for us. The airframe construction plans, Section I consists of a total of 84 pages 24" x 36". These are broken down into 5 segments. Segment A is 3 pages and consists of the contents, the bill of materials, a description and introduction to the Defiant. Segment B is 6 pages containing an up to date education on the use of composites. Segment C is 14 pages and contains 588 photographs showing actual construction methods and details. Segment D is 58 pages and contains all of the drawings and illustrations including all necessary full size templates and jigs. Segment E is 2 pages and contains the information required to finalize the Defiant through white paint.

Section II, which will be available within about one year, will contain all of the information necessary to install both engines, cowlings, props and spinners. In addition there will be details on electrical wiring, main wheel pants and nose gear doors.

The Owners Manual will be available by January 1, 1985. It will contain the normal operating procedures, emergency procedures, weight and balance information, performance charts, maintenance procedures and flight test procedures.

Fred reports that he has had the homebuilt prototype back home in the garage to prepare for the trip to Oshkosh. One of the main reasons was to get the main wheels faired in with wheel pants. He has also installed a transponder and a stereo tape deck and has been working on the nose gear doors, but told us last week that he probably would not have time to get the doors operating to his satisfaction and have them finished in time for the trip.

VOYAGER
On June 22, 1984, early in the morning before the desert warmed up or it became windy, the Voyager taxiied out from Hanger 77 and began a series of taxi runs on Mojave's runways 30-12. Each run was made a little faster. Soon daylight was seen between the tires and the runway - the Voyager was airborne! The taxi runs were conducted with the rear engine running, but with the front prop removed. The front prop was installed out on the taxiway, a quick but thorough inspection was made. Dick taxiied into position on Mojave's 30. Mike and Doug took off in the Grizzly to fly chase and to document the event on video tape.

The Voyager began to roll. The acceleration was amazing! The Grizzly pulled in low and close on the right wing just as the Voyager rose majestically into the air. It looked incredible. Dick climbed out straight ahead, gently feeling out longitudinal, lateral and directional control and stability. The Grizzly moved underneath looking for discrepancies. Mike called Dick on the company frequency, "You have a major oil leak on the front engine". Dick calmly replied

that he was shutting down and securing the front engine. A quick discussion with Burt and it was decided to continue the flight but to remain in the immediate vicinity of the airport.

The air was glass smooth, and the Voyager was an awesome sight to see. The wing tips were bent up like a huge bird. The impression Mike had from the Grizzly chase was that the airplane was sailing across the sky, much like a sail boat on the ocean, a very exciting and satisfying feeling for all of those who worked so hard to reach this point.

After about 40 minutes of getting familiar with this large of an airplane, Dick announced that he was returning to land. Cameras were clicking and video cameras running as he entered left downwind for runway 30. A slight breeze (5 knots) has come up, giving him a slight crosswind from the right. He turned final, the gear was down (it had not been retracted) and floated down to a perfect touchdown.

Of course everyone was elated. The aircraft had performed aerodynamically flawlessly. Burt had predicted how it would fly and once again, he was exactly correct.

The airplane had been under construction in the RAF hanger for 18 months. Dick was pleased with the flying qualities. The pitch stability, its ability to hold a trimmed airspeed is really amazing. The airplane has 6 flights on it at this time for a total of 20 hours. One flight alone accounted for 11 hours. Dick reports that he has flown for hours at a time without touching the control stick. He turns with the rudder and the airplane holds airspeed and altitude all by itself.

So far the flight test data is very encouraging and has backed up Burt's original calculations and predictions almost exactly. A few more flights are needed to really nail down the power requirements and it is a possibility that the Voyager may attempt a closed course distance record between Mojave and Oshkosh during the week of the Oshkosh flyin. This will depend on the weather of course, and also on our ability to get the airplane thoroughly ready for such a flight. We are optimistic at this time. In fact every one involved with the program is pretty much elated by the excellent results of flight testing so far.

We had an "official" press day on July 3, 1984 and as a result, the Voyager was seen in flight on all three major TV networks, as well as on many local TV stations. See Page 9 for more photos of the Voyager.

VOYAGER VIP CLUB

The response to our request for comments on the idea of a VIP club (Voyager Impressive People) has been excellent. Based on this response, a decision has been made to go ahead with the VIP Club idea. A final format or contribution level has not been decided on. Voyager expects to have all the details thrashed out before Oshkosh, 1984. Voyager will have a booth at Oshkosh and anyone interested in the VIP Club can obtain details at the booth or you can write or call:

Voyager Aircraft Inc.

Hanger 77, Airport
Mojave, CA 93501
(805)824-4790

RECORD SETTING EZ'S

July, Friday 13, 1984. Gary Hertzler's VariEze, N99VE with Jeana Yeager at the controls, took off from Bakersfield attempting to break the CI-A closed course record held by Leeon Davis in his Dave DA-5. Davis' record was 2262 statute miles. Jeana took off at 6:40 p.m. and flew throughout the night between Meadows Field and Merced Airport. This meant she needed to complete 8 laps to break the record, we were hoping for 9. After 8 laps, she figured she could just get in the 9th and in fact she flew over halfway towards Merced before she decided to play it safe and return to Meadows. The rules say you must land at the airport you took off from for a closed course record. So she will only be credited with 8 laps, a distance of approximately 2424 statute miles. Actual distance flown was almost 2700 miles.

Gary's VariEze was flown back to Mojave and given a thorough preflight which included removing the cowling, changing the oil, tightening the alternator belt and retorqueing the prop. One cowling screw was missing. It was replaced using Loc-Tite!

At 11:46 p.m., Gary Hertzler took off from Mojave airport in an attempt to set a back to back record this time the straight line distance record in the C1-A class (maximum gross weight = 1102 lbs). Gary had head winds until almost Albuquerque, where they switched to light tailwinds. He had lots of weather, including thunderstorms. After a nasty experience with a thunderstorm over the Smokie Mountains, he decided to call it a day. He landed with almost two hours worth of fuel on board at Martinsburg, West Virginia, approximately 14 hours and 50 minutes after departing Mojave. The straight line distance measures approximately 2227 statute miles, which easily breaks Al Lesher's 1975 record of 1835 statute miles in his Continental O-200 powered Teal.

The important thing to remember is that these results are provisional, and are pending ratification from the FAI. We are confident of ratification though, because in both cases the barograph functioned correctly and all the turn points and landing points were verified.

We are very proud to have these records back in the "fold" so to speak. For those of you who may not remember, Dick Rutan, flying Burt's Volkswagen powered original prototype EZ, broke the closed course distance record during Oshkosh 1975. Leeon Davis broke Dick's record and has held it ever since. Thanks to Jeana and Gary, this record once again belongs to a VariEze. Congratulations guys, you did good!!!

LONDON TO PARIS POINT TO POINT RECORD

A new World Record was recently set in Europe in a VariEze. The airplane, F-PYIP belonging to Henri Christ was flown from London to Paris at an average speed of 167.7 mph, brake release to touchdown, by Gerard Felzer. His passenger was Alain Souchon. This point to point record has been ratified. Congratulations Gerard, Alain and Henri.

IVHC JACKPOT, NEVADA FLYIN

Sally and I flew our Long-EZ N26MS From Tehachapi, California to Jackpot, Nevada direct at 13,500 feet in 3.1 hours, brake release to

touchdown. This is approximately 480 nautical miles (552 sm) which gives an average ground speed of 155 knots (178 mph). Total fuel burned was 17.4 gallons which is almost 32 mpg. The direct route from Tehachapi to Jackpot takes you over some pretty spectacular landscape, however it is very desolate with quite long distances between airports. There are dirt roads that would suffice for an emergency landing but you would be faced with a long walk out in many areas.

Jackpot is in the extreme northeast corner of the State of Nevada, only a mile or two south of the Idaho state line. The elevation is 5,200 feet and the airport consists of a good hard surface runway about 5,300 feet long. The Casino/Hotel, Cactus Pete's is a modern facility with very comfortable rooms, swimming pool, tennis courts and a golf course. Of course there is also the gambling casino. All of this is within easy walking distance of where you tie down your airplane.

Twenty four EZs flew in over the three day weekend. Fifteen VariEzes and nine Long-EZs and 1 Vari-Long. They came from all over, Greg Coln flew his EZ in from Cleveland, Ohio. Byron and Coyla McKean flew up from southern Texas.

This was the second Jackpot flyin and was again organized by Shirl and Dianne Dickey of Salt Lake City, Utah. These folks do a superb job of organizing the flyin. This was the most enjoyable and best organized flyin Sally and I have been to. There were about 50 people who enjoyed the Friday night dinner/show. On Saturday, Shirl had set up three races, standard VariEze, standard Long-EZ and Unlimited EZs, called the Jackpot 120. The race is from Jackpot to Wells airport, about 61 miles south and back, a total distance of 122 miles. An airborne start, similar to Reno air races with the clock being stopped as each airplane crossed the finish line at Jackpot. The Wells airport is the turn pylon with the FBO being the pylon judges to ensure legal turns.

This is a no excuses speed race. The only thing that counts is speed. The fastest airplane wins. Cactus Pete's put up $800.00 in prize money, which Shirl set up so that the prize money was paid down to fifth place in each race. The winners of each race received a beautiful trophy as well as the money. Second place one a plaque and money. It cost $10.00 to enter each race and it was worth every penny, even if you did not win! Some knowledge of navigation by pilotage is required, since the race in generally run at fairly low altitude and navigation facilities are essentially useless except possibly for Loran-C!

The exhilaration of speeding over the hills and ridges looking for every bit of lift from thermals or ridge lift to "surf" on, to pick up every available mile an hour, is

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really fun. Dick Kreidel and I were very evenly matched in the Long-EZ race and the lead changed several times on the way to the turn point at Wells. However I managed to beat him in the pylon turn. I was fortunate to win the Long-EZ class as well as the unlimited class, and this of course made a great weekend ever better. Rich Clark in his

very clean VariEze won the VariEze class for the second year. The results of the 3 races are listed below.

On Saturday night, Casino Pete's provided us with a banquet room with a super meal. After the awards were handed out, I gave a short talk on the progress of the Voyager. Rich and Carol Clark presented an excellent slide show of the trip to St. Croix in the Virgin Islands and back in EZ-Go, their trusty VariEze.

On Sunday morning, several EZs departed for the ride home and the rest of us participated or watched as we tried to cut a toilet paper roll as many times as possible after it was tossed from the window of a Cessna. This was a lot harder than it looked but great fun. Jim Heitkotter won with Shirl and I tied for second place.

Start planning now for next years event. This is the neatest flyin around. Shirl and Dianne will be hosting it again over the 4th of July. Sally and I will definitely be there. Here is a list of EZ people that were at Jackpot 1984.

VariEze

Rich Clark	- 184.92 mph
Steve Sorensen	- 179.78 mph
Shirl Dickey	- 179.65 mph
Gerry Gardner	- 178.99 mph
Bryan Giesler	- 171.38 mph

Long-EZ

Mike Melvill	- 186.84 mph
Dick Kriedel	- 184.71 mph
Gus Sabo	- 177.97 mph
Alan Dierkson	- 176.54 mph
Debbie Iwatate	- 172.46 mph

Unlimited

Mike Melvill	- 187.25 mph	- Long-EZ
Dick Kreidel	- 185.91 mph	- Long-EZ
Ken Swain	- 185.13 mph	- VariEze
Shirl Dickey	- 179.65 mph	- VariEze
Wes Gardner	- 179.81 mph	- VariEze

Dick and Sam Kreidel won Grand Champion for their beautiful Long-EZ. Greg Coln the Longest Distance Award for coming from Ohio.

The following list are the names of the folks that flew in. Quite a few builders drove in also

Shirl and Dianne Dickey	VariEze
Ken and Nancy Swain	VariEze
Steve and Joanne Sorensen	VariEze
Debbie and Ken Iwatate	Long-EZ
Byron and Coyla McKean	VariEze
Gerry and Karen Gardner	VariEze
Al and Karen Dierkson	Long-EZ
Don and Darlene Young	VariEze
Rich and Carol Clark	VariEze
Jim and June Heitkotter	VariEze

San and Dick Kreidel	Long-EZ
Larry and Shirley Freeman	VariEze
Bob Scott*	VariEze
Bruce and Bonnie Tifft	Vari-Long
Greg Coln	VariEze
George Kelley	Long-EZ
Wes and Milly Gardner	VariEze
Gus Sabo*	Long-EZ
Phil Supan*	Long-EZ
John and Eric Sheffles	Long-EZ
Scot Parkinson	Long-EZ
Chuck Parkinson	VariEze
Laughlins*	VariEze
Brian Giesler	VariEze
Mike and Sally Melvill	Long-EZ

Al and Mable Coha - drove all the way from San Diego.
* Please forgive me, I've forgotten your lovely partner's names.
(Note: Mike has been named the "Mojave Flash"!!!)

CAFE 400 - 1984
RAF was represented this year by Mike and Sally in their Long-EZ, and Gary Hertzler, Richard Wallrath, Steve Sorenson, Bob Beard, Jim Skilling and Sasha Munir in their VariEzes.

The race was exceptionally well organized. The weigh in procedure is now down to a fine art, and although a different course was run than last year, everyone seemed pleased with it.

Mike and Sally had an experimental carburetor on their "Long" for the race and did not have time to get it set up. So on the way up from Mojave they flew a series of speed/power points to determine the speed to fly in the race, when they experienced detonation and extremely high EGT indications. Although they managed to get things under control, the engine did not run smoothly the rest of the trip, nor did it run well during the race. This was a shame, because it had been running quite well and they were hopeful of a good score.

Gary Hertzler had honed his now legendary VariEze (powered by a stock Continental A-80, 80 hp) to an even finer peak of efficiency. It is a good thing he did his homework because Gene Sheehan really put in a lot of effort to get his Q-200 ready also. Gary was well prepared and won the two seat experimental category handily with a speed of almost 150 mph at an unbelievable 46 mpg! The Q-200 was faster than Gary's VariEze but only achieved 38 mpg. A Q-2 powered by a Revmaster engine came third at almost the same speed as Gary but with about 41 mpg. This is probably the best comparison between these airplanes. A light weight VariEze with the Continental A-80 engine, and a Q-2 about the same weight with a 70 hp Revmaster. These two should be close in performance and efficiency. Obviously the VariEze is a lower drag airframe because it not only flew slightly faster, but is used considerably less fuel to do the same distance carrying the same payload.

Mike finished in 6th place with a speed of 165 mph at 31.5 mpg which is an improved score over last year. Mike was happy, considering he fact that the engine would not run smoothly at any power or mixture setting and fuel flows were higher that what they had normally been getting.

Upon checking the compression when they returned home and they found it to be down to 71/80. This was not good considering that the engine only had 200 hours since new piston rings, and a valve job. The engine returned to running smoothly after the original carburetor was reinstalled, although down on power.

Dick Rutan entered his own Long-EZ in the Exhibition category. This category did not restrict the payload to 200 lbs. per seat as the normal category does. Dick loaded his airplane up with 800 lbs. of payload! (In fact he believes he could have carried 1,000 lbs.!). This is equal to a four place aircraft with four 200 lb. people! He took off well before the 2,000 foot chalk line and flew the course at 158 mph at 28.3 mpg. He set a score of over 3.6 million, considerably higher than any score ever at the CAFE race. This is the first time that a Long-EZ has been able to show what it can do when not restricted by rules and regulations designed to enable "spam cans" to compete. Dick's score wiped out even the winner of the productions single engines, a 6 place Bonanza which carried a payload of 1,200 lbs.!

A Long-EZ cannot compete head to head with a VariEze using CAFE 400 rules of fixed payloads, however, when it comes to carrying a tremendous load at a decent speed with excellent miles per gallon, which is after all, what the word "efficiency" means, no airplane currently available can compare with a Long-EZ.

The CAFE race is always a lot of fun and we would encourage EZ pilots to try it next year. Watch for a detailed race analysis in an upcoming Sport Aviation.

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.

DES Desired - strongly recommended but not requiring grounding of the aircraft.

OPT Optional - does not effect flight safety.

OBS Obsoleted by a later change.

MEO Minor error or omission.

No VariEze Plans Changes

LONG-EZ PLANS CHANGES
LPC #118, High performance rudder plans, page R-2. Top left hand corner. The sketch shows the hinge attach screws and nutplates to be on the rudder and the rivets to be on the winglet. This is in fact reversed as can be seen in Photos #23 and #24. The hinge should be permanently mounted into the rudder with rivets and the attach screws and nutplates should be in the winglet.

Clarification
High performance rudder plans. The dimensions shown are what we used to mount these rudders in 3 different Long-EZs and are correct. The 39" dimension from the top of the rudder down to the "kink" in the rudder trailing edge is a reference dimension. The "kink" in the rudder varies from plane to plane. To lay out the rudders on your winglet, follow the instructions exactly as called out on Page R-1.

SOLITAIRE PLANS CHANGES
SPC #48
Section I, Page 9-3. The lower right hand corner shows the area that is peel plied for a later 2 ply BID layup. That layup is never called out. The proper time for the layup to be installed is before Step V on Page 9-4. This is the best time to apply this layup. However, if your project has gone past this point this is not a problem, it can be applied at any point after Step IV.

SPC #49
Section I, Page 14-3 - Spoilflap Actuation. Paragraph #6 on the right column should be inserted after the second sentence of the second paragraph. Also the position of the spoilflap handle is not shown on the FS 72 bulkhead as called out in the first chapter. The location is shown in the engine section plans. It is possible to determine the position from the photo on Page 1-1. The important consideration is to allow adequate hand clearance from the longeron. Note that because of the different spacing of the legwell bulkhead, the instrument layout will be different than on the prototype. This is detailed in the engine section.

Solitaire Builder Hints
Section I, Page 15-1 - Installing the Rear Splash Guard. We had a letter from a builder indicating that the splash guard would rub the wheel at full compression of the rear suspension. The splash guard on the prototype will not rub, however due to possible variations, check this before installing the splash guard. The travel on the rear suspension is 1.3" total. If necessary move the splash guard forward to allow 1.3" vertical clearance on the tire.

BUILDER HINTS
Paint - Primer paint for composites. Originally RAF recommended Dupont 70S as a primer. This paint has a high percentage of carbon black and gives excellent UV protection, but it is not the best as far as a good base for the more expensive top coats, such as the polyurethanes. We were recommending Dupont 100S as a replacement for 70S, because it also gave good UV protection and much better adhesion to the top coat, but it has now been discontinued. Dupont 131S is the recommended replacement. Any of Dupont's top coats, acrylic lacquer, acrylic enamel or polyurethane (Imron) will go well with 131S.

We recommend a urethane paint over lacquer or enamel, simply because the urethanes are tougher, more flexible, and stick on better. We recently painted an airplane using Ditzlers Deltron Urethane. It went on well, it looks great and it is reportedly easy to repair.

Whichever top coat you decide to use, (we recommend a good brand name such as Dupont, Ditzler, Sherwin Williams, Sterling etc.), we would strongly recommend that you use the particular manufacturer's product from the glass structure out. In other words, you have contoured your airplane with dry micro and have gotten through the feather fill of Sterling contouring step and are ready for primer. Pick out a manufacturer such as Ditzler and use their recommended "system" from the undercoat or primer through to the top coat.

Our research has shown that this procedure will result in adequate ultra violet protection, and it will also give you the builder the best chance of a lasting finish that will not crack or peel. In the past, some builders have mixed manufacturers, such as Dupont primer and Sherwin Williams top coat. Normally this should work alright, but if it does not, you have no recourse to either of the manufacturers.

Final Contouring - When you have contoured your aircraft according to the finishing section, using dry micro, and are ready for the "feather fill", here are a few suggestions.

Feather fill is a polyester product and it has been commonly recommended by RAF for over eight years. Recently we tried a few other similar products, one of them was Sterling primer/filler which does the same job as feather fill and it is a direct substitute. To compare the two materials, feather fill is a polyester and therefore has poor adhesive qualities. It is

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mandatory to scratch the surface with 40 grit sand paper to allow for a mechanical bond. Feather fill works best in dry conditions, such as we have here in the desert. Feather fill does not like humidity or moisture and you must not ever wet-sand feather fill. There have been a few cases of airplanes having their finish peel off in quite large pieces. The failure was at the feather fill to glass bond line, and invariably this kind of failure can be traced to moisture, high humidity conditions during application, wet sanding the feather fill etc.

Sterling primer/filler (U-1761, U-1762) on the other hand, is a urethane product. Urethanes are famous for their adhesive qualities and given a clean surface they will generally stick forever. Sanding the glass is still recommended however, as there is nothing more disappointing than having your beautiful finish peel off! Sterling can be applied in high humidity environments, even in a pouring down rainstorm. Wet sanding is recommended. In other words, the material is essentially impervious to moisture. Sterling is more expensive than feather fill and it does seem to be slightly more prone to having pin holes after final sanding. But these can be filled with more Sterling, or 3M Spot Putty. We at RAF have used Sterling on several aircraft over the past two years and we are generally quite satisfied with it.

Sterling's biggest attribute as far as we at RAF are concerned is the fact that it cures rapidly and can usually be sanded within 45 minutes to an hour.

Recently we tried a new material (to us), Morton's Eliminator. This is a dark gray polyester type material, rather similar to feather fill. Morton's Eliminator has a few special properties that make it quite desirable. It cures quite rapidly, and the cure can be accelerated with heat. It is formulated to provide an absolute moisture or solvent barrier. Any material applied over "eliminator" will not penetrate and get under it and cause it to separate. It is designed to eliminate pin holes. It builds up well and is a good contouring medium. It sands readily once fully cured. We have not finished a complete airplane with it at this time, but we have used it on some glass parts and have been impressed by its performance. We found that the following procedure worked best for us while using Morton's Eliminator. Sand the parts to provide a good scratch for a mechanical bond. Spray a fog coat over the entire part and allow to flash off. Spray a medium cross coat over the part and before it dries, squeegee the wet material using a soft rubber squeegee. Use firm pressure to assure that the material is drawn into every scratch and pin hole. Smooth the surface with the squeegee as much as possible. Allow to flash off for 15 to 20 minutes. Spray a light cross coat over the whole thing, concentrating the spray wherever it obviously needs it, such as a particularly deep scratch or dent. Allow to cure per the instructions on the can. In a 70 degree F environment it takes 4 hours, 90 degrees F it takes 70 minutes. If you heat it to 105 degrees F, it will cure in 40 minutes. Sand with 180 grit wet or dry. It is now ready for whichever primer and top coat you have decided to use.

Brake pads - As reported in a previous newsletter, Dick Kriedel and Mike Melvill have been trying a new Cleveland brake pad. This is a semi-metallic material and works quite well. Brake effectiveness is increased and brake pad life is extended. It is important however to use the correct break-in procedure for this type of pad or you will not realize its full potential.

Remove your wheel pants and taxi at 40 to 50 knots. Execute three consecutive hard brakings to a stop. Do not allow brakes to cool between brakings. This procedure will glaze the brake pad surface and prevent uneven pad wear and brake disc scoring. This is Cleveland's recommended procedure for the semi-metallic brake pads, Part #66-56. These pads are available from Aircraft Spruce.

If you are using the regular organic Cleveland brake pads (Part#66-2), and entirely different break-in procedure is called for. Remove the wheel pants and taxi at 25 to 40 knots. Brake to a stop using light pedal effort. Allow the brakes to cool. Repeat this procedure a minimum of six (6) times. This will generate sufficient heat to cure the resins in the pads, but will not get so hot as to cause carbonization. A single hard brake application on organic linings can carbonize and prevent attainment of the correct coefficient of friction for the entire life of the linings (which won't be long).

The above information was sent in by Long-EZ builder, Dick Kriedel, who tells us that you can get an informative catalog containing lots of wheel and brake information for $2.00 from:

Cleveland Aircraft Wheel and Brake Division
Parker Hannifin Corp.
P.O. Box 158
Avon, Oh 44011

NOSE WHEELS

As we stated once before in CP 34, the nose wheel is prone to being forgotten. After all it is retracted when you are parked and while doing your preflight and when it is extended, you are normally in the front seat and unable to look at it. Get into the habit of extending it and prior to climbing into the seat, use your foot to check the friction damping. It won't take long to "calibrate" your foot and soon you will be aware of how it should feel. If it is loose and swings around with little or no drag, DO NOT FLY. Adjust the friction damper to give 3 to 5 pounds of force required to move it when pushing or pulling at the trailing edge of the tire.

If your airplane has a tendency to turn left or right while taxiing straight ahead on a level taxiway with no wind, you probably have your nose wheel mounted so the the nose wheel itself is not perpendicular to the level ground. We have recently corrected this problem on two Long-EZs by removing the four bolts and the 1/8" aluminum plate from the NG15A casting. Then using a home made "puller", consisting of 4 bolts, lots of washers and a spacer, we were able to pop the NG15A casting loose from the nose gear strut. Local heat such as an industrial heat gun can sometimes help.

We ground away some material at the tip of the nose gear strut, such that we were able to reinstall the nose wheel fork and pivot casting(NG15A) with the wheel itself absolutely perpendicular to the ground, with the aircraft level, sitting on level ground. In both cases this made an immediate and dramatic effect, allowing less use of brakes while taxiing, a shorter take off roll, since little or no braking was required and longer brake pad life.

PROPELLER TALES!

Propellers are very important. Check them carefully every flight, and handle them with great caution, they can bite. Check your prop bolt torque regularly. The first check should be done after the first flight on a new prop, then at 10 hours then at 25 hours and thereafter every 25 hours. The recommended torque is between 18 ft./lbs. (216 inch pounds) and 22 ft./lbs. (264 inch pounds). The proper torque on your prop bolts is very important, if the torque gets much below 12 to 15 ft./lbs. it is possible to loose your prop! Recently we were

getting the original VariEze prototype out for a flight. It had not been flown or had the prop torqued in almost one year. All six prop bolts were literally finger tight! There was no measurable torque on any of the bolts.

Once the prop has been in operation for a hundred hours or so, you will seldom find the bolt torque low, except when you have flown from a wet or humid area into a dry climate. Check your prop bolts regularly and save yourself from what could be an embarrassing situation to say the least!

There have been one or two EZ pilots recently who have had their hands or fingers hit by the prop. Hand propping an aircraft engine particularly on an EZ is not difficult, but there is not room for carelessness or lack of concentration. The prop should always be treated like a loaded gun. Be especially careful when

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"backing up" the prop, such as is commonly done to clear a flooded engine. This problem appears to be associated with the larger engines (0-320) more than with the standard 0-235 engines. However, it can happen and if it does it can cause painful cuts and abrasions and even broken bones and will also result in a broken prop. Be careful. Use good safety procedures and never move an aircraft propeller unless you are ready and in position for it to fire.

CARBURETOR FLOATS

RAF has recently received two or three reports from EZ pilots who have experienced problems with floats that become fuel logged and sank in the float bowl. This of course will result in a very over-rich condition and could kill the engine unless the mixture is immediately pulled out to almost idle cut off. RAF has tried to find out what could be causing this problem and we hear rumors that a major AD (Airworthy Directive) is in the pipe line and should be published soon concerning this problem. Apparently the composite floats installed in virtually every Marvel Schebler carburetor is susceptible to this problem and may have to be replaced with a metal float.

Keep a sharp eye out for an unexplained over-rich condition. The engine will generally start to run rough, and may even quit. If this occurs, try leaning the mixture control. If this helps, get back on the ground and pull the carburetor. Have it inspected by a competent carburetor rebuild company. If you have recently noticed you are leaning your mixture more than you used to, suspect that this may be the problem. Do not continue to fly. This can be a very serious problem. The company that owns Marvel Schebler carburetors is:

Facet Aerospace Products Co.
#1410 Highway, 70 Bypass
Jackson, TN 38301
(901)423-2500

This company has issued a service bulletin #A1-84A. This bulletin says the float must be replaced at the next 100 hour inspection or if any of the following three symptoms are seen.

1. Evidence of a flooding carburetor.
2. Rough running at low throttle settings.

3. Inconsistent engine shut down.

If your engine is doing any of the above, contact your local carburetor dealer. Here is southern California, our dealer is:

Aeromotive Carburetors
475-479 Riverside Drive
Burbank, CA
(213)845-7455

Tell them the model of Marvel Schebler carburetor and they have a repair kit which includes two or three gaskets, a clip and pin and a new metal float. For the MA3 carburetor, the repair kit part number is #666915.

ACCIDENTS AND INCIDENTS

A northern California VariEze crashed soon after take off. Several eye witnesses observed the canopy open immediately after lift off. The pilot was observed to reach up to the canopy with both hands. The aircraft veered to the left and struck the ground 200 feet left of the runway centerline. The pilot did not survive. The NTSB investigator confirmed that there was no damage to the canopy latches and that they were in the unlocked position. They noted that there was no canopy safety catch.

See Cp #40, Page 4 for more information on canopy opening in flight. The biggest point is FLY THE AIRPLANE. You can not possibly get back safely if you don't gather your thoughts and concentrate on flying the airplane.

A Long-EZ was seriously damaged after the engine failed a few moments after take off in Minnesota. The pilot executed a 180 degree turn and attempted to land on the runway he had just lifted off from. Unfortunately he misjudged his glide landing on the last 1/3 of the runway. A 15 knot tailwind did not help and he rolled off the end, down a slope into a ravine. The nose gear collapsed, the nose dug in and the airplane flipped. The pilot and passenger suffered only minor cuts and bruises. There was no fire and in fact neither of the fuel tanks was even damaged. An FAA/NTSB investigation failed to reveal any clue as to why the engine had quit. The aircraft had had a similar incident occur just a few days prior to this accident. That time the pilot managed to execute a safe landing. A careful examination of the engine, mags and carburetor revealed nothing. The airplane was then successfully tested, and in fact had flown from southern California to Minnesota with no problem at all.

We talked with the pilot this morning and while driving his damaged airplane home, he had plenty of time to try to think of all that had happened and why it had happened. He came up with a theory that certainly could have been the cause. This airplane had the mag switches (two toggle switches) mounted on the left side of the roll over structure. The switches were not covered or protected inside the roll over structure. Two spiral bound note books were stored in the roll over structure. The pilots theory is that possibly one or both books moved against the terminals of the mag switches and possibly shorted the mags to ground. This would certainly cause the engine to quit. This will be investigated further, but it certainly is something to think about. If you have your mag switches installed in your roll over structure, insulate the back of the switches or install a cover

over them to prevent anything from coming in contact with the bare terminals.

SHOPPING

RAF has a truly remarkable poster of the Defiant available. This photograph was taken by Steve Werner over Koehn Lake. The water was calm with a perfect reflection of the underside of the Defiant was the result. While trying to get the perfect reflection shot, the Defiant accidentally touched down on the surface of the lake. Steve snapped the picture and the net result is an astonishing photo of the Defiant skimming along on the surface of a mirror smooth lake, with two "rooster tails" of water trailing from the main gear. Fortunately Mike was able to increase power and climb away from this potentially hazardous condition. There was no damage to men or machines. Steve has given RAF permission to use his slide for the production of a really beautiful color poster. This poster is printed on heavy duty paper, 11" x 17", is extremely clear and suitable for framing. This poster is currently available from RAF and we will have it at our booth at Oshkosh. Price is $8.00.

Hot Wire Control

Vince Golden still has his excellent and economical hot wire control available. Price is $12.50. Write to:

Mike Quinn Electronics
2306 American Avenue #1
Haywood, CA 94541

Beautiful custom made desk top models. Defiant - VariEze - Long-EZ are available. Write for quote.

Contact: Rick Santa Maria
624 N. Fifth Street
Montibello, CA 90640
(818)280-6426

FOR SALE

Lycoming 0-235-C1 zero since major. Set up for Long-EZ with new Brock mount and 6" prop extension. $4,000.00 or equivalent Canadian.

Contact: Phil Carter
P.O. Box 1356
Canmore, Alberta
Canada TOL OMO

Lycoming 0-235, 78 hours since factory remanufacture. Complete with accessories.

Contact: Sam Quinn
Box 837
Estacada, OR 90723
(503)630-2518

Accessory case for Lycoming 0-235 machined for fuel pump. $175.00.

Contact: Dave Petrosino

(503)296-9404

FROM THE BUILDERS

We recently received a letter from a Long-EZ builder, Patrick Colin. Patrick built his Long-EZ, believe it or not on the former US atomic testing ground, ENEWETAK ATOLL in the south western Pacific, Marshall Islands. Construction time was 14 months, and Patrick had to have everything shipped in from 4,500 miles away. He says he received excellent service from the approved materials distributors and never made one call or wrote one letter for builder support!!

Soon after completing and test flying N83PC, Patrick was informed that funds for his project on Enewetak had been cut and he had to vacate the atoll. He decided to fly the Long-EZ out and headed for the island of Kwajalein, over 360 nautical miles away over open water. From there he flew via Ponape in the Caroline Islands to Rabual on New Brittain, then finally to Port Monesy in Papua, New Guinea where he landed a new job and is now based. This is about 2,500 miles across the water. Quite a trip to break in a new Long-EZ.

Patrick tells us his Long-EZ caused quite a sensation when he arrived from where no airplanes arrive from, the open Pacific. It took four months and the paper work is almost equal in weight to the airplane, but he got his Long-EZ, the first composite aircraft in Papua, New Guinea licensed and has a PNG airworthiness certificate. As soon as Patrick gets his HG radio installed (required) he and his wife Lori, intend to travel extensively in PNG and over into Australia.

They would enjoy hearing from other builders, particularly those in Australia or anywhere in the Western Pacific. Contact Patrick and Lori at :

Motupore Island Research Station
P.O. Box 320
University of PNG
Papau, New Guinea

HIGH TIME EZ'S INFORMATION REQUEST

This request was published in CP 40, page 3. The idea is to try to build a data base of required maintenance items on VariEzes and Long-EZs. The response to our first request has been disappointing. Please send in you maintenance experience. It could be a big help to present EZ pilots as well as future pilots. The highest time VariEze that we know of is just over 1,800 hours. Several more have accumulated over 1,000 hours. At least one Long-EZ is over the 1,000 hour mark, with several in the 800 to 900 hour range.

Don't let this slide guys, if you have had an on going maintenance problem in any area at all on your EZ, drop us a card and we will assimilate the data and publish it a future CP.

VARIVIGGEN NEWS

We have heard from two Viggen builders this time. Wayne Wilkins reports that his Viggen is rapidly approaching completion, but that although he had high hopes of flying to Oshkosh 1984, it is just too soon. Too bad Wayne, last year we had 3 Viggens at Oshkosh, it would be nice to get a few more all parked in a row.

Arthur Schwartz has repaired his Viggen "Birdie" after his gear failure and subsequent trip off the runway and says that this year he will be at Oshkosh. He plans to fly in the company of his friend Sid Stiber who will be flying his recently completed Long-EZ. We are looking forward to seeing both aircraft at Oshkosh.

We recently heard second hand, of an incident with a VariViggen in southern California. Charles Cowan reportedly took off with a friend from Rialto airport with the intention of visiting the island airport in the sky on Catalina Island. As he overflew the airport at Corona, he experienced a severe vibration, a loud bang and the engine quit abruptly. He whipped his Viggen around and landed successfully on the Corona runway. The Viggen was not damaged, but the engine was shot. Apparently the cylinder base nuts had worked loose, due to excessive paint on the flanges. One cylinder actually fell off, and the resulting damage essentially destroyed the engine. This is a potentially serious problem and all of us should check all nuts, bolts and screws on our engines for correct torque.

This VariViggen was dismantled and trailered back to the shop, there builder Bill Campbell did a very thorough inspection of the airframe. No damage was found. However, this inspection did turn up a few cracks in the end grain of the composite outboard wing stub spar. These were caused by shrinkage of the spruce. In this case the exposed end grain of the stub spar had no moisture protection at all and the dry desert air had caused the exposed portion of the end grain to shrink and develop several cracks. The fix was to "wick" warm epoxy into these cracks and paint several good wet coats of epoxy over all of the wood that was exposed.

Wood aircraft are subject to changes in humidity and it is very important to protect every bit of wood by coating it with a moisture barrier. In the past this was usually spar varnish or something similar. We believe that the best possible protection is Safe-T-Poxy. All exposed wood surfaces should be coated with a good moisture barrier. Inspect your VariViggen carefully all over for any signs of wood shrinkage or surface cracking. Sand all such surfaces and coat liberally with Safe-T-Poxy.

SOLITAIRE NEWS
The current work on the Solitaire has been concentrated on finishing the engine installation section. These should be available two weeks after Oshkosh.

In order to allow photographs of the installation, Number 2 Solitaire has been brought to Mojave from Task Research and an engine is being installed in this fuselage. We are hopeful that a slightly longer propeller will fit into this fuselage than on the prototype, which would improve the propeller efficiency and increase performance. More on this in the next newsletter after we have had a chance to run some tests.

In other Solitaire news the prototype will be at Oshkosh, a chance for east coast and midwest enthusiasts to view this unique sailplane. The Solitaire is of course on display here at Mojave and is demonstrated most weekends.

Rutan Aircraft has received several reports on Solitaire projects and is happy to report that several builders are very close to needing the engine section. Herb Abrams from Ohio has sent some pictures of his exceptional shop and work in progress. He had the wings in progress and the bulkheads in the fuselage and is working on the installation of the landing gear. Herb reports he hopes to fly his Solitaire in the fall on tow without the engine. Bob Matheny has his fuselage assembled, main wings complete, control surfaces built and he reports he is working steadily on the project.

We at RAF are extremely excited at the prospect of homebuilt Solitaires starting to show up at the soaring sights around the country, helping people to enjoy the exciting and challenging sport of soaring.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Ralph Van Cleve's Long-EZ wing jig prior to inserting foam cores.

Patrick Colin's beautiful Long-EZ built on the former US atomic proving ground, Enewetak Atoll in the Marshall Islands, South Pacific.

Ferde Grofe being checked out in his brand new Long-EZ by Neil Hunter. It looks great Ferde!

Three smiling Long-EZ builders just after successfully passing their mandatory static load tests in Switzerland. Holding their canards left to right: Peter Froidevaux, Hans J. Schmid and Fritz Heer.

Ralph's left main wing in the jig with the shear web layup complete.

Trish and Sally drove this enormous trailer containing the Solitaire to Oshkosh, 1983. They will be flying this year!!

Ray Poynor in his clean, stock Long-EZ. Ray is from Sun City, Arizona.

How's this for a pretty panel? Dick and Sam Kreidel's Long-EZ. This is not only a beautiful Long-EZ, it is also the fastest stock 'Long' we have seen. Look for this one at Oshkosh '84.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Solitaire builder, Herb Abram's incredibly sanitary workshop! Note the special built pivoting work bench.

Three, count 'em, three VariViggens together on one airport at Oshkosh, 1983. Len Dobson, Bernard Duneman and Ken Winters.

Herb's left main wing, foam cores and prefab spar in the jig.

Record setting French VariEze on its way from London to Paris, at a speed of 167.7 mph. Owned by Henri Christ and flown by Gerard Felzer.

The Voyager's first time into the light of day, on June 2, 1984. The Voyager's 110.8 foot wingspan, means it must be wheeled out of the 80 foot side door, with the three gear scissors disconnected and the wheels turned to allow it to roll straight out while remaining at a diagonal.

DEFIANT
HOMEBUILT
FOUR-PLACE
TWIN

Introduction

For some time you have been reading about the four place, push pull twin engine Defiant. After five years of enjoying a "one of a kind" aircraft, Burt Rutan has made the decision to release Defiant drawings to the homebuilder. In late 1981 Burt contacted Fred Keller of Anchorage, Alaska and asked if Fred would be interested in building a Defiant and keeping a complete log with updated drawings and photographs as he was building. Fred agreed and at the EAA convention in Oshkosh 1983, Fred's Defiant was on display. Some changes have been made to the original aircraft such as, an increase in span on both main wings and canard and a revised aileron for lighter control forces. The back seat folds forward for a `station wagon' effect that allows two people to use the baggage area for sleeping. The canopy opening has been improved for easier entry. The fuselage has been changed to allow more head room for the back seat passengers.

Fred Keller is now completing the detailed plans for the Defiant. These will be available from RAF in March 1984. The builder support will be from Fred for plans interpretation, and from RAF for general `how to' on the construction.

Description

The Defiant is a four place, canard-type twin with two 4 cylinder Lycoming engines. Engine power can be 150, 160 or 180 horsepower per engine. It's canard configuration provides several important benefits as compared to conventional twins; (1) Packaging is considerably more efficient - it has a standard-size cabin in an airframe whose whetted area is only 60% that of a conventional light twin. (2) The smaller airframe also has reduced structural load paths allowing a structure much lighter than a conventional twin while having better durability and a higher `g' capability. (3) The tandem wings allow natural aerodynamic angle-of-attack limiting, thus, the airplane is stall resistant. (4) The tandem wings, using winglets for directional stability provide a 30% reduction in induced drag compared to a conventional aircraft with the same span loading. (5) Flight control systems are simpler and lighter. Elevators are only two feet from the control sticks and they provide a flap effect without having separate flaps, thus, at low speed the canard has a deflected full span slotted flap, yet the pilot has no flap control to adjust.

The rudder is only one foot from the pilot's rudder pedals. It is designed to provide control, yet have no effect on stability. Ailerons on the aft wing are controlled from their inboard end such that the entire wing and vertical fin assembly is built without any moving parts.

The small chord elevators and ailerons allow control forces compatible with a side-arm control stick. This allows more precise, less fatiguing control and provides improved use of primary instrument panel space.

Instead of the complex electrical system with one buss and battery tied to two alternators, the Defiant has two simple separate electrical systems, each with its own battery and alternator. IFR avionics are split to both systems so that no single failure can effect essential equipment. Both engines can be started simultaneously. The two systems can be tied together to run all equipment from one alternator in the event of a failure. Also, a low battery can be charged by the other engine without ground electrical equipment. Thus, the electricals are much like conventional fuel systems, i.e., completely independent but with "crossfeed" available in an emergency.

The fuel system consists of a 58-gallon tank with a large sump for each engine. The two systems are independent and require no pilot action for normal operations. Crossfeed is available. The sumps are accurately gauged and are equipped with low level warnings, such that when 45 minutes fuel remain the pilot not only has a warning light, but has a gauge that moves full scale for the last 45 minutes fuel. He can then intelligently plan his options when fuel is low, knowing quantity to within 1/3 gallon of fuel. The last one half gallon of fuel can be used in all normal attitudes. While appearing small outside, the Defiant is quite roomy inside. It has a cockpit width at the elbows of 46 inches (43 inches at rear seats). Knee and leg room for the backseats is a full eight inches more than current light twins. The Defiant has a large baggage area aft of the back seat and even larger if the back seat is layed flat. Two six foot people could use this area to sleep in. The unique semi-supine seats provide a significant advantage in comfort over conventional seats. With a conventional seat, the upright pilot carries all his weight on the buttocks and small portion of the thigh. The Defiant's seat is reclined a full seven degrees more and armrests and headrests are provided for all seats. Thus the body weight is distributed over the lumbar, forearms, thighs and head, rather than being concentrated in the tailbone area. In general, a person who normally finds himself fatigued after a two to three hour flight, will be comfortable even twice that long in a well supported reclining seat.

The side arm controller and throttle system places the pilot's arm in a more natural position while flying and frees his lap area so he can use an airline type lunch tray for maps, approach plates, computers or lunch. Space efficiency and panel visibility is considerably increased when the control wheels are eliminated.

The aircraft is very basic in its systems. It will never require maintenance nor have an AD issued on its flaps, retractable main gear, cowl flaps, governors, hydraulic system, oleos, stall warning, nor

emergency gear extension system, since these were eliminated in the basic design. The remaining systems (flight controls, power plant installation, electrical system, fuel system, etc) are all very basic and simple compared to the conventional light twin. This saves weight, reduces maintenance and increases availability and reliability.

Visibility, particularly in the pattern, is superior to current light twins. The canard wing is at approximately the same height as the nacelles on a Seneca II. Forward downward visibility is adequate over the canard during normal climb, approach and landing flare. Absence of a wing above or below the cockpit area results in a welcome improvement in visibility over conventional aircraft.

Flying Qualities
Flying qualities are conventional with the following exceptions: (1) Spiral stability is positive and speed stability is high, such that the aircraft flies "hands off" indefinitely once trimmed, even in turbulence. (2) There are no pitch or roll trim changes due to configuration or power. Once trimmed at approach speed it will hold that speed hands off during power changes and landing gear extension. The airplane is very stiff in yaw with high damping. Yaw oscillations damp in one to two cycles after a side slip release, as compared to three to six cycles for a conventional light twin. Roll rate is excellent. Adverse yaw is low enough that all normal maneuvering can be done with "feet-off-pedals" resulting in less than one-half-ball yaw excursions.

The Defiant is a very stable IFR platform with a very solid "big airplane" feel. It holds a desired approach speed with less attention than a conventional light twin.

Performance
In general, simplified systems means reduced performance. Not true for the Defiant. Overall performance and efficiency is significantly better than conventional light twins. Data discussed below are for 160 BHP engines. Time-to-climb to 12,000 feet is 10.3 minutes with full fuel and four adults and 7.7 minutes with two adults and 400 nm fuel. At maximum cruise speed of 184 knots (75% power), total fuel flow is only 17.8 gal/hr giving a 1.74 nm/lb economy and a range of 1044 nm with reserves. At 55% power (168 knots) total fuel flow is 13.9 gal/hr giving 2.00 nm/lb economy and a range of 1208 nm with reserves. At low cruise (40% power, 150 knots) range can be stretched to over 1300 nm with reserves. At equal loading and speeds, Defiant gets over 50% more miles per gallon than a conventional light twin! Holding capability is also impressive. At medium weight Defiant can remain aloft on only 40 thrust horse power (64 brake hp) for a maximum endurance of over 14 hours. The excellent two-engine climb capability allows cruise altitudes as high as 18,000 feet with 4 adults and full fuel. The prototype has climbed above 28,000 feet at light weight, single place. This climb capability is far in excess of similarly equipped light aircraft. (Fixed pitch prop and no turbocharger).

Single Engine Capability

In contrast to all other light twins, in which after engine failure a many-step procedure must be accurately followed during which aircraft control and airspeed control are critical, the Defiant makes no demands on the pilot to follow procedures. He can even use any excess airspeed over the minimum full-aft-stick speed to zoom over an obstacle. Once over the obstacle he can maintain aft stick and climb away (single engine) or accelerate without altitude loss to best climb speed. This unique capability is best shown by comparing the Defiant's takeoff profile with that of a conventional light twin (figure I). Both airplanes are at maximum gross weight. Both aircraft experience failure of the critical engine at 10 foot height. Neither aircraft can land and stop in the remaining runway, so they must continue the take off. The conventional twin pilot must immediately do the following: (1) raise gear (2) identify failed engine (3) retard throttle on failed engine (4) cutoff mixture on failed engine, (5) feather failed engine, (6) bank five degrees toward operative engine, (7) carefully raise flaps, (8) Maintain 82 KIAS to 50 foot altitude. After 50 feet (accel-go procedure) he accels to best angle of climb speed (95 knots) and thus, does the best he can do to clear any obstacles. Height-distance profile for this is shown as the lower line in Figure I. Note that even though his eventual climb gradient is adequate (193 feet per nautical mile) the 310 is nearly 4500 feet from brake release before reaching the 50 foot height, and that unless airspeed control and procedures are accurate he will likely crash during this climb segment.

The 310 is one of the best light twins to perform this profile. The "light-light" twin types will either have less performance or will strike the ground during segment A.

The other lines on Figure 1 represent the performance obtained by the Defiant for several conditions. The lower lines are obtained if the pilot elects to fly at the best single engine rate-of-climb speed. Note that if the pilot does nothing but maintain airspeed he will clear the 50-ft obstacle at 3300 feet, even with the gear down.

FIGURE 1 OMITTED

The upper lines on Figure 1 indicate an even more interesting capability of the Defiant. Suppose a tall obstacle exists at the end of the runway. The Defiant pilot can pull back the stick to zoom over the obstacle, even slowing to his minimum speed of 65 knots. After clearing the obstacle he can merely hold the stick aft and safely climb away even if he leaves the gear down (no procedure). If any conventional light twin attempts this, an accident will result, since, they cannot climb when near min control speed or stall speed. If desired, a standard rate turn can be initiated following an engine failure during lift off at gross weight.

Specifications and Performance
(with 160 BHP engines, fixed Props).

Engines (2)	Lycoming 0-320
Seats	4
Basic Empty Weight	1600 lb.
Equipped Empty Weight	1680 lb.
Equipped useful Load	1270 lb.
Gross Weight	2950 lb.

Fuel Capacity	115 gallons
Span	31.4 feet
Wing Area	133 square feet
Wing Loading	22.2 lb/square feet
Power Loading	9.2 lbs/hp
Payload with full fuel	660 lbs.
Max Cruise (70%)	184 knots
Fuel flow at max cruise	17.8 gph.
Range at max cruise (45 min reserve)	1044 nm
Economy Cruise (55%)	168 knots
Fuel flow at economy cruise	13.9 gph.
Range at economy cruise (45 min reserve)	1208 nm
Climb Rate (2950 lbs)	1500 fpm
Climb Rate (2220 lbs)	1900 fpm
Single Engine climb (2950 lb)	310 fpm
Single engine service ceiling (2950 lb)	6500 ft.
Single Engine Climb (2200 lb)	550 fpm
Stall Speed (2950 lb)	64 knots
Stall Speed (2200 lb)	58 knots

Cost and Time to Build the Defiant
The cost of the materials list has not been completed at this time, but we estimate the cost of building the Defiant will be approximately "two Long-EZs", between $20,000 and $30,000. Remember that avionics can cost you as little as $1000 or as much as you wish to pay.

Time to build the Defiant, again will be "two Long-EZs" as it is the same type of construction, just more. A competent builder can build a Defiant in as little as 2000 man hours. Until the plans are completed, it is difficult to say how many of the parts will be available prefabricated and this would make a difference to the time to build.

	U.S.A.	Overseas
Canard Pusher Newsletter	$ 6.75	$ 8.75
Defiant Plans - Section I	$490.00	$510.00
Defiant Engine Installation	not available at this time.	
Defiant Owners Manual	not available at this time.	

Voyager first flight June 22, 1984. Note very little paint on underside of aircraft. Photo by Doug Shane. **PHOTO OMITTED**

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 42. If you are building from 2nd Edition plans you must have newsletters 18 through 42. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 42. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 42. If you are building a Long-EZ you must have newsletters from 24 through 42. If you are building a Solitaire, you must have newsletters from 37 through 42. If you are building a Defiant, you must have newsletters from 41 to current.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
We have been working hard on the new Long-EZ canard and have almost 200 hours of test flying on four different versions of the new canard. This week we are flying the final version in its final configuration on the prototype N79RA. RAF has also provided test pilot support to Scaled Composites for Burt's latest airplane, the Predator. Predator is a new generation of agricultural aircraft (crop duster) and is a canard type airplane with a small horizontal tail, actually a three

surface airplane. Look for information in the upcoming aviation magazines.

We have built an engine mount for the plans built Solitaire and actually installed it into a homebuilders fuselage. Since the plans built version of the Solitaire is a little different than the prototype, it was a big help in getting the engine installation plans done.

Defiant builder support is picking up and several builders are really going fast on their projects. Right now it looks quite possible that one or more homebuilt Defiants may be at Oshkosh 1985!

RAF travelled to the Brown Field flyin at San Diego, California with Burt's Defiant and Mike's VariViggen. VariEzes and Long-EZs as usual were far and away the most numerous types at the flyin (38). We flew to the Copperstate flyin in Eloy, Arizona. This is really a fun flyin, with lots of EZs and with lots of flybys flown by more different types than you see at most flyins. Dick Kreidel won the Best Composite award for his beautiful Long-EZ.

WHAT IS THE BIG NEWS AT RAF?
New Canard for the Long-EZ? New project in the shop? Voyager flew it's mission? NO, NO, NO. BURT IS GETTING MARRIED!! On November 16, 1984, Burt will be tying the knot with a lovely lady, Margaret Rembleski (some of you met Margaret at Oshkosh). He calls her "Sunshine" as she always has a smile and sure makes Burt smile a lot!! Congratulations Burt and Margaret.

OSHKOSH '84
Oshkosh has come and gone once again. If you have never been to Oshkosh, you really owe it to yourself to go, at least once. It is impossible to describe. It is huge, it is busy, there are tens of thousands of people and thousands of airplanes. It is mind boggling. It is neat. It is Oshkosh.

RAF was well represented as usual with 48 registered VariEzes, 33 Long-EZs, 3 VariViggens, 2 Defiants, 1 Solitaire and 1 Voyager. A total of 88 Rutan designs were tied down on the field at Oshkosh during the convention. As usual several pilots did not register. Irene Rutan (Burt's Mom) knows of at least two EZ pilots who did not register but were there for all or part of the week. This gives us a total of 90 aircraft at Oshkosh '84.

As we have always said, our moldless design such as is used on the EZs, is the fastest way to build a one off airplane (which is what each of our homebuilts is!). If you doubt this, count the airplanes at flyins, not just at Oshkosh, but any flyin, the Copperstate flyin, the Brown Field flyin, Watsonville flyin, Merced flyin, Sun 'n Fun flyin etc. At all of these flyins, EZs out number any other type, including the so called prefab, snap 'em together composite airplanes. Don't just believe all the advertising you see, go to the local and national flyins and count the airplanes. Talk to the builder/pilots. You will soon find out which are the easiest and fastest to build, and the best flying and most useful cross country airplanes. Enough said!!

Canard Pushers from 1 to 82

The big news at Oshkosh this year was the spectacular arrival of the Voyager. Dick and Jeana flew to Oshkosh from Mojave, landed at Oshkosh after the Sunday airshow, and kept the airplane on display for the entire week. The Voyager was flown several times and judging from everyone's reaction, created quite a sensation. Since Oshkosh, the Voyager has been undergoing more flight testing here at Mojave, and has been flown as heavy as it will be during testing, with no problem. In fact for the heavy weight flight, the Voyager took off with right at 60 percent of it's weight in fuel. The take off roll was a short 2300 feet. At this weight, the Voyager could have broken every existing distance record on the books. To make it all the way around the world, it will obviously be carrying even more fuel but at this point we do not expect any problems.

Burt has turned the Voyager over to Dick and Jeana - he is satisfied that the airplane has the capability to do the job. He has specified what the power requirement will be and now Dick and Jeana will take the Voyager through Phase II. That is to prepare it for the around the world flight, this is mainly avionics, engines as well as the human factors.

A lot of EZ builders and pilots have joined the Voyager VIP club. This has been a great help. A lot more help is needed. We would encourage anyone interested in seeing the Voyager successfully fly around the world to join the VIP club. Lets keep Voyager as a grass roots effort. Write to Voyager for details.

Voyager Aircraft Inc.
Bldg 77, Mojave Airport,
Mojave, CA 93501
805-824-4790

Aircraft Registered at Oshkosh 1984

VariEze		Long-EZ	
John Levy	CA	Joe Sabo	NV
Byron McKean	TX	Jan Van Noord	CA
Greg Coln	OH	David Domeier	CT
Shirl Dickey	UT	Norman Howard	CA
Delmar Hoagland	IL	Errol Mann	MN
J. Armstrong	TX	Robert Prior	CA
Bruce Stephens	MA	Donald Livengood	NY
Jack Day	CA	Joe Yasecko	FL
Mike Slingluff	ME	Jack Hare	MI
Gary Price	ME	Neal Johnson	LA
Steve Wright	FL	Sam&Dick Kreidel	CA
Jack Fehling	FL	Richard Dorman	NH
Gerry Mason	MI	Darwin Esh	WI
Frank Dudley	FL	Beau Wold	MN
Gary Hertzler	AZ	Tom Garrison	TX
John Faulkner	CT	Harris Howard	TX
Richard Wallrath	CA	Kenneth Hanson	CA
Gerald Edmonds	WY	Sheldon Olson	WI
Bob Evans	WY	Bruce Tifft	CA
Wes Gardner	CA	Steve Bowser	CA

Harry Robins	MO	Mike Melvill	CA
Jim Bair	IO	Don Maher	FL
K. Speckman	MN	Lynn Burks	CA
Fergus Fay	CA	Paul Adrien	NH
Quinton Daniel	MI	Curtis Baker	AZ
Bill Cormier	MA	Ferris/Johnson	CA
Ray Lancaster	TX	Sidney Stiber	NY
T. Thornhill	TX	Judge King	MN
W. Butters	MO	George Scott	TX
Mule Ferguson	NC	Phil Supan	CA
Don Jones	TN	A. McCumber	MN
John Frilling	IL		
Roy Blaha	FL	VariViggen	
Robert Beard	CA	Ken Winters	OK
Ken Swain	NB	Bernard Duneman	MN
Lynn Coltharp	OK	Arthur Schwartz	NY
Leonard Brown	NY		
Stephen Sorenson	CA	Defiant	
Bob LeMaster	WI	Burt Rutan	CA
Michael Marker	NM	Fred Keller	AK
Thomas Hazelrigg	IL		
Ron Menzie	AT	Voyager	
Cy Gaskey	IL	Dick Rutan	CA
Steve Kelly	CA		
Ronald Kapperman	OK	Solitaire	
Gene Zabler	WI	RAF	CA
James Townsend	CT		

SHANANDOAH VALLEY 500 (The old Dulles 500)
Vic Mondary in his VariEze came in First Place in the two place category, First Place in the homebuilt category, First Place using auto gas and Second Place overall. He was beaten by Mike Smith in his Bonanza but only because Vic got a "little" lost on the way to the first pylon. A Long-EZ came in Third. Vic averaged 146.6 mph for 500 kilometers (310 miles) and carried a 513 lb payload. Congratulations Vic, you done good!!!

AVIATION ART SHOW
St. Joseph's Hospital in Tampa, Florida is planning on holding an aviation Art Show and they would like to hear from artists (painters, photographers, or others who produce hanging art) who would like to show their works at this event. It will be held this fall.
Contact: Lize Kalashian
813-870-4340

CLUB NEWS
Long-EZ builders in the Chicago area, interested in getting together and exchanging information and experiences, contact:
Roger Shem,
14540 Oakley,
Orland Park, IL 60462
312-349-0510

Defiant builders in the Chicago area, VariEze builder John Steichen, is working on his Defiant and would like to share information, skills, possibly even jigs and fixtures with other area builders.
Contact: John Steichen,

960 86th St,
Downers Grove, IL 60516
312-985-6671

NEW AIRFOIL FOR LONG-EZ CANARD?
As many of you know, Mike and Sally had a different airfoil canard on their Long-EZ at Oshkosh. The purpose of this airfoil was to try to lower rotation speed, to try for a little higher performance (lower drag) and to try to eliminate the small nose down trim change that occurred at cruise power in the rain. The new airfoil in fact achieved all three objectives. However it had a glitch at 70 to 80 knots, in other words right in the approach to landing mode. We have made several changes since Oshkosh in an attempt to cure this small corner of the envelope. Unfortunately, when we fix this, we lose it somewhere else. We have recently built an entirely new canard, new airfoil and new plan form that is currently being flown on the Long-EZ prototype. We do not have sufficient data to release any information in this newsletter, but we will continue to work on it. When we have it refined to our satisfaction, we will make an optional set of plans available for it. It is difficult to predict when this will be, due to our work load here at RAF.

Please don't call us on this, as there is nothing we can release at this time. When we are ready, we will publish it in the CP. If you are ready to build your canard, go ahead. If you can delay it for 3 or 4 months by building winglets, wings or whatever, it may be a good idea to do that.

DEFIANT
Johnny Murphy, builder of a Quickie, a VariEze, a Long-EZ, a Mead Adventure and a Glasair is really going to town on his Defiant. Johnny has both wings, both winglets, the centersection spar, the canard and elevators all complete. He is currently building fuselage bulkheads. Charlie Gray builder of two Long-EZs is not far behind. Charlie and a friend are building two Defiants and already have completed 4 wings, 4 winglets, 2 centersection spars and 1 canard! Several other Defiant builders are also making rapid progress.

Fred Keller is working on the engine installation plans, or Section II. These plans will include all the information to install either conical or dynafocal mounted engines, as well as electrical wiring diagrams, pitch trim system, baffling and cowlings.

RAF has asked Ken Brock to make almost all of the Defiant metal parts. We have supplied Ken with a list of these parts in the order that they will be required, provided the builder works in the order that the plans are written. It will of course take some time to tool up and manufacture all of the metal parts to build a Defiant, so don't expect Ken to have them available overnight. Give him time and if you are interested in buying Defiant metal parts, let him know. He is interested to know just how many builders there are out there who would buy the prefab parts.

Task Research has available the main gear and is currently tooling up to produce cowlings and possibly the turtle deck, aft of the canopy back to the rear cowl. Task would really like to hear from the Defiant builders as to the interest in the prefab parts. If you are planning

on building a Defiant, please either drop a note to Task or RAF, letting us know if you would be interested in buying the cowlings and the turtle deck prefabricated. This will really help us in determining the tooling.

HELP!
"I was fruitlessly trying to repair my motor glider at Fox Field one Saturday in July this year, when a VariEze builder, I think his name was Hank Aldrich, offered to give my friend and I a ride back to Santa Monica Airport, where my car was. Unfortunately when I got out of his car, I left a small bag containing a transceiver and a set of car/house keys. I don't know how to contact him, he does not know me.
Please call - Byron Alexander - (213)398-4093
Thanks"

AN ALASKAN ADVENTURE
Mike and Sally, Bonnie and Bruce Tifft and Fred Keller had planned a trip to Anchorage, Alaska for the period after Oshkosh 1984. On the Sunday after Oshkosh, Fred's Defiant and Mike and Sally's Long set off for Minot, North Dakota where they planned to meet Bruce and Bonnie. Some real serious scud running was required in western Wisconsin and eastern Minnesota but the rendezvous was made on schedule. The next morning the flight of three flew to Edmonton, Alberta, where the tower requested and got a three ship formation flyby. From Edmonton we flew to Fort St. John where we spent the night. Next day we flew along the Alkan highway up to Fort Nelson where the weather was on the ground. A quick 180 and back to Fort St. Johns (nice to have all that range). Later we were able to make it through, although we had to do a little cross country away from the highway plus some fairly good scud running, which required more than a little pucker power on the part of some of the crew. We made it into Watson Lake in glorious sunshine and spent the night. Watson Lake is a really neat place. Early next morning we left for Northway, Alaska. Again we found ourselves doing some serious scud running between Whitehorse and Northway. We cleared customs and had the best home made pie ever. We ran into bad weather at Gulkana, but with Fred's knowledge of the area, we were able to sneak under it and around it and finally found our way to Fred's home base, Merrill Field in down town Anchorage. We stayed with Fred and his wife Sharon-Kay and had the best time ever.

While taking off to fly in an airshow at Merrill Field, Mike had an exciting time, when a valve stuck on his 0-235. Our schedule was so hectic, we were unable to look at the engine, but on returning from Valdez, we found a bunch of homebuilders, including a VariEze builder/flyer, Ron Himmelberg and a Long-EZ builder had removed the cowling and had pulled the cylinder! These Alaskans certainly are the most helpful folks. An engine rebuilder was located only 200 yards from our parking place and he had everything ready to go in two days including getting parts from "outside" (the lower 48). Bruce and Mike got the engine all back together and test flew it at 10:30 P.M. that evening, in broad daylight. Big "thank you" to Bruce for all that hard work.

Next day Mike and Sally flew to Fairbanks and back to break in the new overhaul, flying very close to Mount McKinley. It was a crystal clear day and the 20,000 plus foot high mountain was breathtaking. The engine ran well and they felt confident to try the trip home.

Too soon it was time to leave Fred and Sharon's wonderland, so we bid a tearful farewell. We flew non stop to Whitehorse in the Yukon, where we stopped for lunch and customs. After lunch we flew to Fort Nelson where we spent the night. The weather was perfect! Next morning we flew to Willians Lake, a little of the now familiar scud running was required. Flew on to Pentecton, Canada. After landing, Bruce did a brief check of his airplane and found that the main oil seal had broken and was lying in the bottom of the cowl! Once again more helpful folks made repairs easy. After spending the night, we jumped across the US/Canada border and cleared customs at Spokane, Washington. We had breakfast and then Bruce and Bonnie departed to visit friends at Grants Pass and Mike and Sally headed for home.

What a fantastic trip. Canada and Alaska are truly magnificent. Have you ever had 100 miles visibility and looked out and seen nothing but majestic mountains, rivers, lakes and fabulous trees? Awesome. What memories - flying along the face of the Columbia glacier in a Grand Champion Widgeon, courtesy of George Pappas, flying a super cub on floats out of little fresh waters lakes, looking for mountain sheep in steep glacier cut canyons, watching the salmon making their way up the rivers, dinner at the top of the tallest building in Anchorage. The people in Canada and Alaska honestly enjoyed sharing their wonders with us. Super folks.

If you ever have the opportunity to fly your EZ up to Alaska, don't pass it up. Do learn all you can about the trip. AOPA can be very helpful. Read Don and Julia Downie's book "Alaska Flight Plan" and go for it. It is not to be missed.

Some statistics for the trip on N26MS. Total distance travelled from Mojave to Oshkosh to Anchorage and back to Mojave - 6920 nautical miles (7963 statute). Total hours on the Hobbs meter - 61.6 hours (engine running time, including taxiing, side trips, Oshkosh flybys etc). Total fuel burned for trip - 308 gallons. Average fuel burned per hour - 5.0 gph. Actual flight time, Mojave to Mojave - 54.7 hours. Average ground speed for trip - 126.5 knots (145.5 mph).

SOME THOUGHTS ON COOLING
The following observations are based entirely on my own experiences over 900 hours of flying in my Long-EZ, N26MS.

Since first flight in January of 1981, my engine, a Lycoming O-235-L2C, baffled exactly per section IIL of the Long-EZ plans, has run with cylinder head temperatures that were not even, to say the least. Cylinder #4 (forward right side) had always run the hottest. Cylinder #1 (aft left side) had always run the coolest. At normal cruise power in level flight there was normally a disparity of up to 100 degrees F between these two cylinders. Cylinders #2 and #3 ran within 5 degrees of each other at all time (#2 is aft right side and #3 is forward left side). This problem was not entirely as bad as it sounds in that even the hottest cylinder #4 never did exceed or in fact even come close to the red line temperature as called out by Avco Lycoming. (500 degrees

F as measured at the bayonet fitting under the cylinder head, not at the base of a spark plug).

On an average cross country trip, in stabilized level flight, my cylinders would run as follows: #1 - 280 degrees F, #2 - 345 degrees F, #3 - 341 degrees F, #4 - 413 degrees F. We flew the airplane for over 700 hours with this condition. Over this period I tried many small ideas in baffling, tightening the baffles, loosening the baffles, sealing every single little gap in the baffles. None of these changes made a really significant improvement.

Sure I picked up 5 and 10 degree increments from time to time, but I was trying to cure a 100 degree difference! There is not enough space here to list all the different ideas I tried, but they included removing the intake duct completely, and installing a throttle body fuel injector instead of a carburetor.

Finally I tried a small deflector plate, consisting of a piece of .032 aluminum approximately 4" x 5". I bent it so I could rivet it to the inside of the lower cowling lip. I mounted it off center on the right side, under the #4 cylinder, hoping perhaps it might aim the incoming, high velocity cooling air directly at the #4 cylinder. See sketch. **SKETCH OMITTED**

I test flew it, with little enthusiasm and was amazed to say the least. #4 was now the coldest cylinder. Unfortunately #2 was not too hot, however I now knew I was onto something. To make a long story short, I tried 6 different iterations of various width and height of deflectors in several positions on the lower cowling. Currently I have 3 deflectors, one on the left side, one on the right side, and one on the centerline, aft of the carburetor. See sketch. **SKETCH OMITTED**

These deflectors are made of foam and glass (1 ply of BID over pour-in-place). My results at this time, with 150 hours of flight time on the above, maximum power climb to 12,000 feet, #3 cylinder is the hottest at 435 degrees F, #4 is the coolest at 395 degrees F. In level flight at 8500 feet, at an economy cruise power setting (approximately 60 percent) of 17" manifold pressure, 2500 RPM, indicating 121 knots for a true airspeed of 136 kt/157 mph (OAT plus 1 degrees C) fuel flow was 4.4 gph. Cylinder #1 - 345 degrees F, #2 - 31 degrees F, #3 - 338 degrees F, #4 - 343 degrees F.

On another trip at 8500 feet at maximum available power (approximately 75 percent) 21.4" manifold pressure, 2850 RPM, indicating 146 knots for a true airspeed of 163 knots (OAT +4 degrees C) fuel flow was 6.4 gph. Cylinder #1 - 363 degrees F, #2 - 361 degrees F, #3 - 364 degrees F, #4 - 363 degrees F.

So it can be seen that with a little trial and error, the cooling air deflectors can be made to work rather well. I don't claim that they will work for everyone, but I believe that if you are having similar cylinder head temperature disparities, it may be worth a try. I must emphasize that this test was done on a Long-EZ with a flush NACA cooling inlet and a Lycoming O-235 engine. Whether or not this idea

would work on an airplane with a standard ram inlet, I can't say, but again, it may be worth a try. Remember that I have all four cylinders instrumented with CHT as well as EGT with a calibrated digital gauge, so I knew at all times what was happening with each change.

BUILDER HINTS

Bondo for jigging - When you position your winglet onto the tip of your wing, be careful to sand the wing and the winglet locally where you apply the bondo that will jig it into position for the structural layup. If you do not sand the glass, the bondo may not hold, and it is possible that the bondo will fail in the middle of the cure cycle of the structural glass layup. This can cause the winglet to be misaligned incidence wise. This has happened before and it can happen to you. Sand the glass wherever you intend to apply bondo for accurate jigging purposes.

Spruce blocks in the Long-EZ centersection spar. These four wood block are microed into the foam core such that they touch the forward edge of the spar caps and extend forward 3". They are there to absorb the crush forces when the two bolts that attach the engine mount extrusions to the centersection are tightened. It is important that these bolts go through the spruce blocks. See sketch. **SKETCH OMITTED**

CAUTION
When mixing epoxy and micro balloons, wear a dust mask and keep your face away from the balloons that may float up into the air. Although these glass balloons are inert, they can lodge in your eyes or in your lungs and can cause problems. Handle with care.

LONG TERM MAINTENANCE ITEMS ON EZs
Quite a few EZs, both VariEze and Long-EZs have now accumulated over 1000 hours of flight time. We have requested feed back from the builder/pilots of these aircraft regarding maintenance.

Problem - Paint flaking off, particularly at the dry micro to featherfill juncture and especially in humid climates.
Solution - Sand glass and dry micro filled areas thoroughly with 40 grit. Use Morton's Eliminator or Sterling primer filler instead of featherfill. Use primers and finish coat by the same brand name manufacturer, i.e. Dupont primer 131S and Imron or Ditzler primer Preet 33 and Ditzler Durethane polyurethane enamel system.

Problem - Nose wheel friction damper seems to loosen after one or two flights.
Solution - Remove fork and pull phenolic friction button. Ream the hole the phenolic button slips into, to allow a little clearance. The problem seems to be caused by the phenolic button being driven into the hole, against the spring, by a hard landing and then becoming stuck. Get it to work in and out freely, adjust the spring to give 2 to 4 lbs of side force measured at the trailing edge of the nose tire with a fishing scale, and you should have solved the problem.

Problem - Long-EZ exhaust system support bracket cracking. Either the brace or the tab welded onto the exhaust pipe will fail.
Solution - Remove the braces completely and allow the exhaust pipes to float free. They will only be attached at the engine exhaust flange.

Experience has shown this to be the best method, no bracing is required.

Problem - A few builders report that nosewheels are turning, not on the tapered bearing, but on the 1/4" bolt at the spacer/bushing. Apparently no combination of torque on the bolt will cure it once this occurs.
Solution - Machine a spacer to install between the aluminum bushings so that when the 1/4" axle bolt is torqued up, it can be tightened up solid on the two existing bushings and the new spacer. The trick is to machine the spacer to exactly the proper length to ensure that the two taper roller bearings in the wheel are just right, not too tight and not too loose.

Problem - Nose gear downlock bouncing out of over center locked position, putting all loads onto wormgear teeth. Of course this strips off about half the teeth on the wormgear.
Solution - Rotate wormgear 180 degrees and you back in business. Worm and wormgear should never see the loads (other than retraction and extension). The mechanism must go over center. To ensure it stays in the over center position, some form of friction must be maintained at the gear handle pivot in the instrument panel. Try shimming the oval shaped green plastic bearing block to misalign it and put the handle shaft "in a bind" so to speak. You just need enough friction so the gear retract mechanism will stay in the down and over center locked position as well as in the up position.

Problem - VariEze main gear attach tabs. The 1/4" diameter holes in the aluminum extrusions elongate and become loose on the AN4 (1/4") bolts. Check for this by lifting the airplane so that the main wheels are clear of the ground. Grab the gear strut close to the tire and attempt to move the wheel fore and aft. Any movement at all would indicate the above condition.
Solution - Remove the main gear attach bolts and ream the 1/4" holes in the extrusions up to 5/16" diameter. Replace the AN4 bolts with AN5 bolts and torque them to approximately 125 in/lbs.

Long-EZ Operations - Carburetor ice can be a real hazard. Do not omit the installation of a good carb heat system. When the temperature and humidity are just right and you are flying at a relatively low power setting, you can get carburetor ice, even in a Lycoming. The classic evidence of ice is an unexplained drop in RPM. Should this occur, go to full power immediately and apply full carb heat. This condition is not nearly as common in the Lycoming installation as in the Continental installation, but given the right conditions it can occur. Do not assume it will never happen to you.

Brakes sticking on - A few builder/flyers have experienced the peculiar phenomenon of brakes that remain on after being applied. The causes of this have not been easy to find, but it does occur. Look for the following possibilities: 1) Automotive brake fluid instead of aircraft grade. This can damage the 'O' rings and seals and cause the brake master cylinders to stick. 2) Check the 1/8" size plugs in the top of the reservoirs to be certain that they have vent holes drilled in them. This should be a 1/16" diameter hole. Without this vent, it is possible to have the brake master cylinders stick. 3) Be certain that your brake linings have not worn down to the point that the

pistons in the brake calipers (at the wheel) can be forced out of the caliper far enough, that the piston can become cocked and bind so that it can not retract into the caliper. 4) If these conditions persist, you will have to dismantle the brake master cylinders and overhaul them.

CP42, Page 4

Summary
We have 3 Long-EZs and 1 VariEze here at Mojave, all of which are 4 years old or more. The total hours on these four EZs exceeds 3,300 hours. We have never had a problem related to the composite structure. We have not had a composite structural problem reported to us from the more than 600 EZs that are now flying world wide in all different climates and conditions. We are very pleased with the structural performance of these airplanes and we encourage all builders to continue to send in reports of any maintenance items that you may encounter so that we can look for any trend that may develop and report on it in the Newsletter to help all of the EZ builder/flyers out in the field.

LATEST PROP INFORMATION
The following information (in alphabetical order) was supplied by the respective prop manufacturers at RAF's request and is current information as of October 19, 1984.

B & T Propellers (209)742-6743
Bruce Tifft,
3850 Sherrod Road,
Mariposa, CA 95338

Bruce says that his best all around props are the following:

Continental O-200 VariEze	- 58 x 70
Lycoming O-235 VariEze	- 58 x 72
Lycoming O-235 Long-EZ	- 62 x 66
Lycoming O-235 High compression Long-EZ	- 62 x 68

Bruce was the first of the homebuilt prop builders to provide urethane leading edge protection on his props and it is the best rain erosion protection available. Bruce is now full time in the business of carving props and had built and flown a VariEze and is currently flying his new modified Long-EZ.

Great American Propeller Co (805)481-9054
1180 Pike Lane #5
Oceano, CA 93445

Fred Griffith reports that their props are now cut from FAA certified blanks. These blanks are made from 31 laminations of Canadian maple, glued together with phenolic based glue and are very hard and tough. With one of these props, the prop bolts can be torqued to 20 to 22 foot lbs (240 to 264 inch lbs) and experience has shown that this amount of torque does not crush the prop hub, with the torque remaining consistent over 25 to 50 hours of flying. In addition, these props have a covering of Kevlar on the outer 70 percent of each blade. While the Kevlar provides excellent splitting protection, you should throttle

back to 2500 rpm or less in rain. Great American includes a flyer on prop installation and care with each prop shipped out. Be sure and read this information. Fred informs us that they now have in stock and available, loaner props for most EZ/engine combos.
Best all around props are:

Continental O-200 VariEze	- 56 x 68
Lycoming O-235 VariEze	- 58 x 65
Lycoming O-235 Long-EZ	- 62 x 62
Lyc O-235 high compression Long-EZ	- 62 x 64

Teds Custom Props (206)568-6792
9917 Airport Way,
Snohomish, WA 98290
Ted Hendrickson was the first supplier of props for VariEzes back in 1976. He has consistently supplied high quality props for all types of engine/EZ combinations. All of Teds props are supplied with his version of the urethane "rain" leading edge. Ted reports about a 90 day delivery time, but that he will work with you in an emergency.
Ted's best all around props are:

Continental O-200 VariEze	- 56 x 70
Lycoming O-235 VariEze	- 58 x 74
Lycoming O-235 Long-EZ	- 62 x 66
Lyc O-235 high compression Long-EZ	- 62 x 68

CAUTION
Do not neglect to check your prop for the correct torque. We have had this caution in the CP before, but we continue to hear of EZ flyers who have had props come loose or even loosing a prop. As an example, we had not flown the prototype VariEze N4EZ for almost 9 months. It was stored in a hangar on the Mojave airport. The desert dry air caused the prop to shrink and when we checked it prior to flying it, there was essentially no measurable torque on any of the bolts. Mike checked the prop bolts on his VariViggen, N27MS after it sat in the hangar for almost as long. The torque was less than 50 percent of what was normally required. A homebuilder checked the torque, went flying and lost the prop, all six bolts had broken. All six bolts were bottomed out on the threads and were not tight on the prop! This is a real gotcha! Be sure that bolts are not too long. Add a washer or two if they are. Do not ignore this problem. If you do, it will definitely bite you.

We at RAF normally check a brand new prop after the first flight, then after 10 hours and then at 25 hours. Now, after a prop has 100 to 200 hours on it, it is usually compressed and stabilized and in fact, we seldom find any discrepancy in the torque on airplanes that are flown often. However, we still check them, and we strongly recommend you do the same. This is very important and could save you and your airplane from a serious problem, that can be avoided with a few minutes of preventive maintenance.

ACCIDENTS AND INCIDENTS
A South African Long-EZ crashed off the end of a 1700 feet rough field when the pilot attempted to take off with a quartering tailwind. The airplane accelerated slowly on the very rough strip and failed to lift off before running off the end of the strip into a marsh. The nose gear collapsed, the nose dug in and the airplane flipped. The pilot and passenger were both injured and airplane badly damaged.

This accident was one that need not have occurred. The Long-EZ is not suitable for short rough fields. You can land a Long-EZ on a rough strip that you may not be able to fly out of. Remember, with a canard pusher configuration, such as the Long-EZ, you have no prop blast over the elevator, and therefore you can not force the airplane to rotate early and start the wings carrying load. You have to accelerate to flying speed, 50 to 60 knots depending on the cg and a rough field or even a grass field with long grass (anything over 2" long) will greatly add to the rolling drag and slow down your ability to accelerate to the point that you may need more runway than you have available. As long as you fly your Long-EZ from a hard surface or a smooth grass field at least 2500 feet long, you should have no problems. All aircraft are compromises, you cannot have a Lear jet and a J-3 cut in one aircraft. The Long-EZ is no exception. It does what it was designed to do very well. High speed, economical transportation is the Long-EZs forte.

VORTILONS FOR VARIEZES

These little wing leading edge fences, or more properly, vortilons, have been seen by many builders on Mike and Sally's Long-EZ N26MS. Since Oshkosh '84, we have been testing them on several airplanes including the prototype Long-EZ, N79RA. We also received expert assistance from Chuck Richey who installed and tested them on his VariEze, and from Gary Hertzler who did essentially the same thing on his VariEze and from Bruce Evans who installed them on his VariEze and test flew it to Oshkosh.

We are pleased to be able to report that the vortilons, as shown here (full sized patterns) are approved for installation on VariEzes as called out. They replace the leading edge cuff, which should be removed if using the vortilons. There is little or no speed penalty caused by the vortilons, but there is a very noticeable improvement in takeoff and climb performance. Visibility over the nose during rotation for lift off as well as in the flare for landing is greatly improved. Stall characteristics are also improved at all weights to gross and at all c of g conditions from 97" to 102.2".

The installation information given is for VariEzes. The vortilons on the Long-EZ are not as effective as on the VariEze due to the higher sweep angle of the VariEze wing and the different airfoils used on the two airplanes. Vortilons only work on swept wings and will do nothing on straight wings. After considerable testing on 3 different Long-EZs we do not feel there is enough to be gained, to warrant the trouble to install them on the Long-EZ.

FULL PAGE SKETCHES OF VORTILONS FOR VARIEZE OMITTED

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built

experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

No VariEze Plans Changes.

No Long-EZ Plans Changes.

DEFIANT

DPC #1, MEO
Page A-3, Recommended order of construction, paragraph 4, reads, "refer to page B-4" - should read "B-5".

DPC #2, MEO
Page B-1 under TOOLS. #3 list should include a LIETZ mod 11 or Sears Dumpy Level.

DPC #3, MEO
Page C-2, Photo #47 reads 8" - should read 8 feet or 96".

DPC #4, MEO
Page C-3 Photo #100 reads "Heel Saw" - should read "Hacksaw".

DPC #5, MEO
Page C-3 caption is for Photo #104. Discard caption on Photo #104 and insert #103 caption. Caption for #103 should be "Peel ply spar caps as shown".

DPC #6, MEO

Page C-4 Photo #153 - Reads "Binding", should read "Bending".

DPC #7, MEO
Page C-5, Photo #190 - Reads 1.8", should read 1/8".

DPC #8, MEO
Page C-6, Photo #216, reads "B.L. 100" should read "B.L. 180".

DPC #9, MEO
Page C-6, Photo #237 - Reads "to 80 to 100", should read "8 to 10".

DPC #10, MEO
Page C-6, Photo #241, reads "Backsaw", should read "Hacksaw".

DPC #11, MEO
Page C-6, Photo #242, reads 1.8" should read 1/8".

DPC #12, MEO
Page C-9, Photo #351, reads "nose gear finished", should read "nose gear to finish forming box".

DPC #13, MEO
Page C10, Photo #395, should read "allow epoxy to tack for - -".

DPC #14, MEO
Page C-10 Photo #414, reads "1/16" stainless" should read ".016 stainless".

DPC #15, MEO
Page D-26 reads, "1/16" 301 stainless", should read ".016 301 stainless".

DPC #16, MEO
Page D-42 - Note at the bottom of the center of this page, reads "drawing of C-28" should read "drawing of C-29".

DPC #17, MEO
Page D-29 "B" pattern - insert dimensions 3"x3".

DPC #18, MEO
Page D-47 - HM-3 Rod end, should read "HF-3 rod end".

DPC #19, MEO
Page A-3. Part # RUD-7 calls for .080 aluminum. Should be .063 aluminum (see Page D-42).

DPC #20, MEO
Page D-28. Wing jig are shown at 78 degrees. Should be shown at 102 degrees.

DPC #21
Bill of Materials. The following parts need to be added to your bill of materials.

Stainless firewall material should be 36" x 80" (not 36" x 60") and can be shipped as two pieces 36" x 40".

3" x 6" .190" 2024T3 aluminum
4 pcs. 2030 x 4 flared tubes
3/4" dia x 6" 4130 steel rod
1 AN960-916 washer
5 AN665-21R fork ends, 5 AN315-3R nuts
5 AN393-11 clevis pins, 5 AN380-2-2 cotter pins
12 wood screws #10 x 1 1/2"
3/8" O.D. x .035 wall x 30" 2024T3 aluminum tubing.
2 HF-5 (MW5 rod ends)
1 F5000-3 (MS21059L3) nut plate

SOLITAIRE PLANS CHANGES

SPC #50
Section I, page 2-2, Bill of Materials. Bolts AN3-4 calls for 4, this should be 8.

SPC #51
Section I, Page 12-1, Wing Attach, Step III. Sentence 4 calls the water lines of the spar cutout at 17.1 to 22.75. The fuselage shells have indents for the spar cutouts and these are correct.

SPC #52
Section I, Page A-2, Part #SP-5 is not called out. The SP-5 bulkhead is installed behind the F.S.112.5 bulkhead as shown on Page A-25. Cut a 2 1/2" diameter hole in the center of the SP-5, sand it to fit and install with micro and 1 ply of BID lapping 1" all around. Do not tape the under side of the bulkhead.

DEFIANT GENERAL

When you layup your 1/4" thick solid glass hard points, such as WA-1 and WA-2, it should take 21 plies of BID. One ply of BID is approximately .012" thick, therefore .012 x 21 plies = .252". Some builders have found that it takes more plies or less plies to make a 1/4" thick glass pad. The 1/4" dimension is important and must be held, therefore you should add however many plies it takes to bring the pad up to the correct thickness, or you should layup less plies as required. Caution. If you find that it takes one or two plies less or even three, thats ok. However if you find that your layup has only half the required plies to make up 1/4" pad, you are doing something wrong! Your glass pad will be used for bearing support at the wing attach fittings, and the number of plies is proportional to the bearing strength. A layup that is half glass and half epoxy is not as strong as this application as a layup with the correct percentage of glass. Check your workmanship.

Note: Wherever aluminum material is called out such as 2024T3, you may substitute with 2024T4 or 2024T351. This is true anywhere in a Defiant, Long-EZ or VariEze.

Note: Aluminum tubing called out as 1200 versatube is the same as 3003-0.

Note: Wherever Nylon sheet is called out, phenolic sheet or Delrin sheet can be used with no problem.

Note: The Defiant material list calls out bolts and screws in the older AN format. Wicks and Spruce has changed the AN part numbers wherever it is applicable to the latest MS numbering system. You still get the same part, but in some cases this can lead to confusion. If you are not sure of what you have, give Wicks or Spruce a call. Don't call RAF, as we do not have any means of cross referencing.

IMPORTANT - When Ken Brock has Defiant metal parts available ready for sale, in order to eliminate confusion, he has requested that Defiant builders add a D in front of any part number from the plans, ie. throttle quadrant handle part number TQ-6 becomes a D-TQ-6.

SHOPPING

RAF has available white polo shirts with pocket with the Long-EZ design and Rutan Aircraft printed underneath. The shirts are $14.00 which includes postage.

Beautiful desk top scale models of the Long-EZ. Ready in mid-November in time for Christmas. $145.00

Contact: Future Wing Models
624 North 5th Street,
Montebello, CA 90640

Aircraft Spruce is now carrying an excellent new canopy seal, as seen on Mike's Long-EZ, N26MS. V-canopy seal sells for $0.40 per foot. 20 feet required per canopy.

Contact: Aircraft Spruce,
714-870-7551

Excellent hotwire power supply for $12.50

Contact: Mike Quinn Electronics,
Bldg 727 Langley Street,
Oakland airport,
Oakland, CA 94614
415-569-1539 (ask for Vinnie)

The lightest, simplest canopy air vent door available. $6.00 each.

Contact: Gene Zabler,
48 Robin Hill Drive,
Racine, WI 53406

For Defiant builders, the Aerorecord Log Book gives you an excellent place to record your progress, includes space for photos of important structure, space to record materials used, engines, props etc. A section on weight and balance, specifically as this relates to your Defiant. A section on AD notes, literally a builders log that will greatly simplify FAA final inspection and years from building will let you look back and see what you in fact actually used, such as paint type and color. This builders log is designed by a former FAA aviation safety inspector and meets all current FAA requirements. We recommend this vinyl bound, loose leaf builders log.

Contact: Gerald R. Redman
2778 Waverly Ave,
Camarillo, CA 93010

805-482-8081
Defiant Log - $27.50
Long-EZ Log - 20.00

Rusty Fosters Space Saver panel has been refined even more! Rusty has done a truly superb job with this prefab fiber glass panel and he sells it as a kit with an excellent set of instructions for the do it yourself builder or he sells it completely prewired, ready to install. Rusty recently moved from the Santa Paula area to northern California. For more information contact:

Rusty Foster,
P.O. Box 1569
Portola, CA 96122
916-832-5993

1/5 Scale Long-EZ model kits manufactured by St. Croix Models, of Park Falls Wisconsin. These are now available at RAF. 20% Discount to Long-EZ builders! These are beautiful models and fly just like the real thing. For more information contact:

St. Croix Models,
P.O. Box 279,
Park Falls, WI 54552
715-762-3226 - talk to Jim Schmidt.

At last, for the composite fanatic, a high tension hot wire cutter! Seriously, while the standard plans built hot wire cutter is an adequate tool, which with care will produce very nice foam cores, this high tension hot wire tool essentially eliminates wire lag. A Long-EZ builder, Tom Berkley, designed, built and tested this hot wire tool. Now that he has perfected it, he has put out a well done set of plans and is offering them to homebuilders. A hot wire tool of this caliber is probably not for everyone, but for the persnickerty builder who likes perfection, why not get him or her a set of plans for Christmas?

Contact: Tom Berkley,
P.O. Box 6184
Tehachapi, CA 93561
805-822-5065

New Book News. "Canard - A Revolution in Flight" by Andy Lennon, Foreword by Burt Rutan. A complete history of canards, tandem wings and "tail first" airplanes. $17.95. Order from RAF or

Aviation Publishers,
P.O. Box 234,
Hummelstown, PA 17036
717-566-0468

FOR SALE

Please Note: RAF cannot advertise parts that are normally supplied by our distributors.

Continental C-85, zero time with VariEze engine mount. I need an O-290.

Contact: Peter Spanovic,
1870 Ben Franklin Drive,
Reno, NV 89509
702-876-7525

Continental O-200 suitable for VariEze, 2927 total time, 1839 since major. Running good. With logs, manual and new Lord Mounts. $1500.00
Contact: Jim Carraway
415-479-3668

Lycoming O-235-C. 800 hours since major includes all accessories. $2500.00
Contact: Don Jackson
213-373-5717

Lycoming O-235-C, 166 since major. New chrome choke bore cylinders, new 100 octane valve guides. Cylinders are currently not installed on the engine. $1500.00
Contact: Brian
818-705-4314

Lycoming O-235-L2C, 500 hours total time, all logs and accessories. $4250.00
Contact: Jim Rodrian
Grafton, WI 414-375-1755

Attention Defiant Builders!!
Lycoming O-320 H2AD, 875 hours since major, all logs and accessories $2900.00.

Lycoming O-320-A3B, 3221 hours total time, 1108 since major - all logs and accessories. $2500.00

1 set 600 x 6 Cleveland wheels and brakes #199-46. $430.00

30 Grimes post lights $10.00 each
3 lighted compasses C-2300 DL4 $40.00
1 Oil screen assembly for Lycoming O-235 - $20.00
Contact: Steve Franseen
1245 South Tennyson,
Denver, CO 80219
-922-6081
-399-8793

Collins 253 VHF radio, 6 preset frequencies, new - retail $2600.00, sell for $1750.00.
Contact: Bob Brown,
421 West Brookdale Place
Fullerton, CA
714-525-8032
714-546-3551

Brand new prewired Long-EZ space saver panel. I won it in the Voyager raffle. Will trade for bits for my Defiant project or make offer.
Contact: John Loofbourrow,
815 Standish Ave,
Westfield, NJ 07090
212-466-1717 (days)

New "Kurth" stainless steel tuned exhaust system for Continental O-200 in a VariEze. Includes muffler. Paid $500.00, best offer.

Contact: Bob Gentry,
1902 30th Street, CT NE.
Sumner, WA 98390
206-863-7339

New Dynafocal engine mount - $150.00
VariEze wing fittings - $100.00

Contact: Robert Bannach
715-344-6970

VariEze nose gear strut and strut cover. Rosehan wheels brakes and cylinders.

Contact: Edward Hanley,
205 W Gum Street,
Marion, KY 42064
502-965-5129

VariEze main and nose gear struts, wing fittings, canopy and many other VariEze parts.

Contact: Dennis Costello,
Rt 1,
Lockport, IL 60441
815-838-2057

Task Research strake sale!!
First come, first served. 50 sets at $884.00.

Contact: Task Research,
805-525-4545

Wanted
VariEze prefab fuel tanks.

Contact: Larry Anderson,
501-855-1281

Torrance Airport Noise Abatement
Mike and Sally recently flew their Long-EZ, N26MS into the Torrance Airport in southern California. This airport has a full time noise measurement system installed and they measure the noise level of every airplane that departs from the runway. Since they simultaneously record the tower transmissions, they know which airplane is making the noise.

They record the loudest one second period during the take off, the maximum allowed is 82 decibels, 83 is a violation. N26MS recorded at 66 decibels. They also factor the noise level over the entire take off period. This is called a Senel scale and the maximum allowed is 88 decibels. N26MS recorded 75 decibels on the Senel scale. This makes the Long-EZ a relatively quiet airplane and certainly well within the limits set by the city of Torrance. This Long-EZ was loaded with two people and about 1/2 fuel and 20 pounds of baggage at the time.

If you fly into Torrance and would like to know what your noise level is at take off, contact David Roelen at the Noise Abatement Center, west of the tower on the Torrance airport. This Noise Abatement Center

is run by the City of Torrance and they are always interested in measuring noise levels in different types, particularly homebuilts. Dave Roelen is a very helpful and interested individual, give him a call at: (213)325-0505.

SOLITAIRE
Doug Shane, a test pilot for Burt at Scaled Composites (he only works three days a week) had some fun flying Solitaire and wrote the following article for us.

"When you are as crazy about flying airplanes as I am, if you are lucky enough to be offered a new type to fly, have the seat belts fastened as fast as possible. The one who was so generous to offer, may suddenly regain consciousness.

And so it was early in the month of September. Mike Melvill offered the Solitaire prototype for a morning of flying. And even though I had flown (in front of) a KFM 107 engine before, I rather hastily accepted.

After a cockpit check and briefing, I started up the engine and did a little ground handling evaluation. At any speed above a crawl, the ailerons are effective enough to raise the low wing and allow taxiing on only the bicycle mains. Nosewheel steering is positive, with light forces (although a fairly large turn radius). The hand operated disc brake is effective enough for taxi use, and visibility is good for ground operations.

The pre-takeoff check consisted of closing and latching the canopy, checking switch positions, and running up the engine to assure adequate static RPM (5700) was available. The takeoff itself was an anticlimax; rotation with full aft stick was at about 35 knots and the airplane flew off almost immediately thereafter.

With only 23 advertised horsepower available, the climb rate was not sufficient to induce eardrum problems, but by remaining in good gliding position during the climb, no severe anxiety occurred. I climbed to about 3500 AGL and spent a little time getting familiar with the flying qualities, stalls, etc. This included shutting the engine down and folding it away a couple of times to get the hang of it .... it works very well.

Much has been written about the soaring performance and handling characteristics by someone infinitely more knowledgeable than I, so I'll just try to relate how much downright FUN the Solitaire is to fly. I shut the engine down over Tehachapi at 7500 feet and climbed to just under 11000 feet. While that high, I did big lazy wingovers, stalls, thermalling turns and evaluated the spoilflaps. Then Mike, who was alongside (sort of) in his Long-EZ suggested that I open the canopy (definitely not recommended in the usual Canard Pusher). Wow! Not only is that fun, but is it ever cold at 11000 feet!

I came down more due to a storm moving into Mojave than due to the airplane's wanting to, but on the way down I was able to evaluate the rain trim change characteristics. Simply, it has none. My first landing was with the engine folded away, as it had been since over 1.5 hours ago, in gusty winds and light rain. Absolutely no problem with crosswind handling or pattern work at all.

The Solitaire really offers a kind of flying that many of us don't understand without some exposure to it. To be able to go out and fly without power, in an atmosphere where you're essentially free to learn at your own pace, in your own way, for virtually no hourly operating expense, is a very wonderful feeling. It's one that I hope others can learn with Solitaire."

VARIVIGGEN NEWS

Once again at Oshkosh '84 we had three Viggens on the field! Arthur Schwartz finally made it to Oshkosh. He has tried for the previous three years and each time had problems that caused him to miss. It was good to see "Birdie" on the line. Ken Winter flew his Viggen up from Tulsa, Oklahoma. This was Ken's third Oshkosh. Bernard Duneman made his second year. Bernard has an interesting forward sliding front canopy.

Mike and Sally's Viggen was dusted off and flown to the Brown Field flyin, San Diego, California and to the Copperstate flyin in Eloy, Arizona. A former RAF employee, now working at Scaled Composites, Doug Shane flew the Viggen to both flyins and really enjoyed the "fighter like" flying qualities of the Viggen. He also flew many flybys and amply demonstrated the unique characteristics of the Viggen. To our surprise and pleasure, there was a second Viggen on the flight line at Eloy. Len "Dobbie" Dobson flew his Viggen in. Dobbie was unable to make it to Oshkosh this year, but hoped to for '85.

Wayne Wilkins is ready to take it to the airport. Empty weight is 1165 3/4 lbs, cg has been calculated and Wayne is ready. By the time you read this Wayne will be flying. He is trying to organize a Viggen builders get together for Oshkosh '85, perhaps in the evening.

That would be great and would allow the Viggen builders a chance to swap information and ideas. Wayne recently flew in the back seat of Peter Lawrence's Viggen (Peter rebuilt Wally Warner's) and says it flies great. Lots of luck Wayne.

Arthur Schwartz reports that he had an uneventful trip home from Oshkosh and that he now has 310 hours on his Viggen. Frank Stites has flown off his restrictions and has been flying in to a few local flyins.

Viggen project for Sale. Asking $3500.00
Contact: Greg Kesel
194 Squiredale Lane,
Rochester, NY 14612.
716-225-6461

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Jacques Causse' beautiful new Long-EZ. Jacques is from Toulouse, France.

Rob Cook's VariEze instrument panel. Rob is coming right along and will fly soon.

Anthony Gittes has his Long-EZ flying in Equador! He had to move it in a C-130 Hercules due to extremely high density altitude. Most of us have adventures getting to the airport, but this takes the cake!!

Bernard Verdon's newly completed Long-EZ was the second Long-EZ to fly in Canada.

Bernard Verdon's Long-EZ instrument panel. Very nice! Uncluttered, simple and functional.

L. K. Bradley of Palm Harbor, Florida. Long-EZ first flight, August 1984.

From time to time we receive suggestions and photos of "easier and better" ways to install Long-EZ main gear struts. This one is from Bob Davenport, (305-567-1844) and is probably the ultimate extreme that a builder could go to! Anyone interested in Bob's method is welcome to call him. Our feeling here at RAF is that the plans method is still the simplest and quickest. But that is what being an "experimentor" is all about!

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Philip Hefferman, of Melbourne, Australia is flying and has been issued a certificate of Airworthiness by the Australian Department of Aviation.

Charlie Gray's Defiant canard jigs set up and ready.

Charlie Gary's Defiant wing jigs, looks like an overgrown Long-EZ.

Charlie's "Big Easy" canard in the jig, with shearweb completed.

Yes Sir! Some builders out there really do the bookend practice layup. This one is from Herb Abrams, Solitaire builder.

Serial Number 00-101, the first VariEze to fly in Belgium, was guilt by Jean d'Otreppe of Borlez-Faimes, Belgium.

Bill Durland, working on his engine installation on Long-EZ at Sedona, AZ.

Johnny Murphy's Defiant wing in the jig with shearweb layup complete.

R. Van Cleve's Long-EZ wing in the jig, shearweb is layed up and once cured, the whole thing will be jigged horizontal for spar caps and wing skins.

DEFIANT
HOMEBUILT
FOUR-PLACE
TWIN

Introduction
For some time you have been reading about the four place, push pull twin engine Defiant. After five years of enjoying a "one of a kind" aircraft, Burt Rutan has made the decision to release Defiant drawings to the homebuilder. In late 1981 Burt contacted Fred Keller of Anchorage, Alaska and asked if Fred would be interested in building a Defiant and keeping a complete log with updated drawings and photographs as he was building. Fred agreed and at the EAA convention in Oshkosh 1983, Fred's Defiant was on display. Some changes have been made to the original aircraft such as, an increase in span on both main wings and canard and a revised aileron for lighter control forces. The back seat folds forward for a `station wagon' effect that allows two people to use the baggage area for sleeping. The canopy opening has been improved for easier entry. The fuselage has been changed to allow more head room for the back seat passengers.

Fred Keller is now completing the detailed plans for the Defiant. These will be available from RAF in March 1984. The builder support will be from Fred for plans interpretation, and from RAF for general `how to' on the construction.

Description
The Defiant is a four place, canard-type twin with two 4 cylinder Lycoming engines. Engine power can be 150, 160 or 180 horsepower per engine. It's canard configuration provides several important benefits as compared to conventional twins; (1) Packaging is considerably more efficient - it has a standard-size cabin in an airframe whose whetted area is only 60% that of a conventional light twin. (2) The smaller airframe also has reduced structural load paths allowing a structure much lighter than a conventional twin while having better durability and a higher `g' capability. (3) The tandem wings allow natural aerodynamic angle-of-attack limiting, thus, the airplane is stall resistant. (4) The tandem wings, using winglets for directional stability provide a 30% reduction in induced drag compared to a conventional aircraft with the same span loading. (5) Flight control systems are simpler and lighter. Elevators are only two feet from the control sticks and they provide a flap effect without having separate flaps, thus, at low speed the canard has a deflected full span slotted flap, yet the pilot has no flap control to adjust.

The rudder is only one foot from the pilot's rudder pedals. It is designed to provide control, yet have no effect on stability. Ailerons on the aft wing are controlled from their inboard end such that the entire wing and vertical fin assembly is built without any moving parts.

The small chord elevators and ailerons allow control forces compatible with a side-arm control stick. This allows more precise, less fatiguing control and provides improved use of primary instrument panel space.

Instead of the complex electrical system with one buss and battery tied to two alternators, the Defiant has two simple separate electrical systems, each with its own battery and alternator. IFR avionics are split to both systems so that no single failure can effect essential equipment. Both engines can be started simultaneously. The two systems can be tied together to run all equipment from one alternator in the event of a failure. Also, a low battery can be charged by the other engine without ground electrical equipment. Thus, the electricals are much like conventional fuel systems, i.e., completely independent but with "crossfeed" available in an emergency.

The fuel system consists of a 58-gallon tank with a large sump for each engine. The two systems are independent and require no pilot action for normal operations. Crossfeed is available. The sumps are accurately gauged and are equipped with low level warnings, such that when 45 minutes fuel remain the pilot not only has a warning light, but has a gauge that moves full scale for the last 45 minutes fuel. He can then intelligently plan his options when fuel is low, knowing quantity to within 1/3 gallon of fuel. The last one half gallon of fuel can be used in all normal attitudes. While appearing small outside, the Defiant is quite roomy inside. It has a cockpit width at the elbows of 46 inches (43 inches at rear seats). Knee and leg room for the backseats is a full eight inches more than current light twins. The Defiant has a large baggage area aft of the back seat and even larger if the back seat is layed flat. Two six foot people could use this area to sleep in. The unique semi-supine seats provide a significant advantage in comfort over conventional seats. With a conventional seat, the upright pilot carries all his weight on the buttocks and small portion of the thigh. The Defiant's seat is reclined a full seven degrees more and armrests and headrests are provided for all seats. Thus the body weight is distributed over the lumbar, forearms, thighs and head, rather than being concentrated in the tailbone area. In general, a person who normally finds himself fatigued after a two to three hour flight, will be comfortable even twice that long in a well supported reclining seat.

The side arm controller and throttle system places the pilot's arm in a more natural position while flying and frees his lap area so he can use an airline type lunch tray for maps, approach plates, computers or lunch. Space efficiency and panel visibility is considerably increased when the control wheels are eliminated.

The aircraft is very basic in its systems. It will never require maintenance nor have an AD issued on its flaps, retractable main gear, cowl flaps, governors, hydraulic system, oleos, stall warning, nor emergency gear extension system, since these were eliminated in the basic design. The remaining systems (flight controls, power plant installation, electrical system, fuel system, etc) are all very basic and simple compared to the conventional light twin. This saves weight, reduces maintenance and increases availability and reliability.

Visibility, particularly in the pattern, is superior to current light twins. The canard wing is at approximately the same height as the nacelles on a Seneca II. Forward downward visibility is adequate over the canard during normal climb, approach and landing flare. Absence of a wing above or below the cockpit area results in a welcome improvement in visibility over conventional aircraft.

Flying Qualities
Flying qualities are conventional with the following exceptions: (1) Spiral stability is positive and speed stability is high, such that the aircraft flies "hands off" indefinitely once trimmed, even in turbulence. (2) There are no pitch or roll trim changes due to configuration or power. Once trimmed at approach speed it will hold that speed hands off during power changes and landing gear extension. The airplane is very stiff in yaw with high damping. Yaw oscillations damp in one to two cycles after a side slip release, as compared to three to six cycles for a conventional light twin. Roll rate is excellent. Adverse yaw is low enough that all normal maneuvering can be done with "feet-off-pedals" resulting in less than one-half-ball yaw excursions.

The Defiant is a very stable IFR platform with a very solid "big airplane" feel. It holds a desired approach speed with less attention than a conventional light twin.

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Performance
In general, simplified systems means reduced performance. Not true for the Defiant. Overall performance and efficiency is significantly better than conventional light twins. Data discussed below are for 160 BHP engines. Time-to-climb to 12,000 feet is 10.3 minutes with full fuel and four adults and 7.7 minutes with two adults and 400 nm fuel. At maximum cruise speed of 184 knots (75% power), total fuel flow is only 17.8 gal/hr giving a 1.74 nm/lb economy and a range of 1044 nm with reserves. At 55% power (168 knots) total fuel flow is 13.9 gal/hr giving 2.00 nm/lb economy and a range of 1208 nm with reserves. At low cruise (40% power, 150 knots) range can be stretched to over 1300 nm with reserves. At equal loading and speeds, Defiant gets over 50% more miles per gallon than a conventional light twin! Holding capability is also impressive. At medium weight Defiant can remain aloft on only 40 thrust horse power (64 brake hp) for a maximum endurance of over 14 hours. The excellent two-engine climb capability allows cruise altitudes as high as 18,000 feet with 4 adults and full fuel. The prototype has climbed above 28,000 feet at light weight, single place. This climb capability is far in excess of similarly equipped light aircraft. (Fixed pitch prop and no turbocharger).

Single Engine Capability
In contrast to all other light twins, in which after engine failure a many-step procedure must be accurately followed during which aircraft control and airspeed control are critical, the Defiant makes no demands on the pilot to follow procedures. He can even use any excess airspeed over the minimum full-aft-stick speed to zoom over an obstacle. Once over the obstacle he can maintain aft stick and climb away (single engine) or accelerate without altitude loss to best climb speed. This unique capability is best shown by comparing the Defiant's takeoff profile with that of a conventional light twin (figure I). Both airplanes are at maximum gross weight. Both aircraft experience failure of the critical engine at 10 foot height. Neither aircraft can land and stop in the remaining runway, so they must continue the take off. The conventional twin pilot must immediately do the following:

(1) raise gear (2) identify failed engine (3) retard throttle on failed engine (4) cutoff mixture on failed engine, (5) feather failed engine, (6) bank five degrees toward operative engine, (7) carefully raise flaps, (8) Maintain 82 KIAS to 50 foot altitude. After 50 feet (accel-go procedure) he accels to best angle of climb speed (95 knots) and thus, does the best he can do to clear any obstacles. Height-distance profile for this is shown as the lower line in Figure I. Note that even though his eventual climb gradient is adequate (193 feet per nautical mile) the 310 is nearly 4500 feet from brake release before reaching the 50 foot height, and that unless airspeed control and procedures are accurate he will likely crash during this climb segment.

The 310 is one of the best light twins to perform this profile. The "light-light" twin types will either have less performance or will strike the ground during segment A.

The other lines on Figure 1 represent the performance obtained by the Defiant for several conditions. The lower lines are obtained if the pilot elects to fly at the best single engine rate-of-climb speed. Note that if the pilot does nothing but maintain airspeed he will clear the 50-ft obstacle at 3300 feet, even with the gear down.

FIGURE 1 OMITTED

The upper lines on Figure 1 indicate an even more interesting capability of the Defiant. Suppose a tall obstacle exists at the end of the runway. The Defiant pilot can pull back the stick to zoom over the obstacle, even slowing to his minimum speed of 65 knots. After clearing the obstacle he can merely hold the stick aft and safely climb away even if he leaves the gear down (no procedure). If any conventional light twin attempts this, an accident will result, since, they cannot climb when near min control speed or stall speed. If desired, a standard rate turn can be initiated following an engine failure during lift off at gross weight.

Specifications and Performance
(with 160 BHP engines, fixed Props).

Engines (2)	Lycoming 0-320
Seats	4
Basic Empty Weight	1600 lb.
Equipped Empty Weight	1680 lb.
Equipped useful Load	1270 lb.
Gross Weight	2950 lb.
Fuel Capacity	115 gallons
Span	31.4 feet
Wing Area	133 square feet
Wing Loading	22.2 lb/square feet
Power Loading	9.2 lbs/hp
Payload with full fuel	660 lbs.
Max Cruise (70%)	184 knots
Fuel flow at max cruise	17.8 gph.
Range at max cruise (45 min reserve)	1044 nm
Economy Cruise (55%)	168 knots
Fuel flow at economy cruise	13.9 gph.
Range at economy cruise (45 min reserve)	1208 nm
Climb Rate (2950 lbs)	1500 fpm

Climb Rate (2220 lbs)	1900 fpm
Single Engine climb (2950 lb)	310 fpm
Single engine service ceiling (2950 lb)	6500 ft.
Single Engine Climb (2200 lb)	550 fpm
Stall Speed (2950 lb)	64 knots
Stall Speed (2200 lb)	58 knots

Cost and Time to Build the Defiant
The cost of the materials list has not been completed at this time, but we estimate the cost of building the Defiant will be approximately "two Long-EZs", between $20,000 and $30,000. Remember that avionics can cost you as little as $1000 or as much as you wish to pay.

Time to build the Defiant, again will be "two Long-EZs" as it is the same type of construction, just more. A competent builder can build a Defiant in as little as 2000 man hours. Until the plans are completed, it is difficult to say how many of the parts will be available prefabricated and this would make a difference to the time to build.

	U.S.A.	Overseas
Canard Pusher Newsletter	$ 6.75	$ 8.75
Defiant Plans - Section I	$490.00	$510.00
Defiant Engine Installation	not available at this time.	
Defiant Owners Manual	not available at this time.	

Predator - an ag plane designed by Burt and built at Scaled Composites. Mike Melvill did the first flight on the aircraft. The Predator has been designed and built for David Record. Photo by Pat Storch.
PHOTO OMITTED

THE CANARD PUSHER NO 43 JAN 85

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 43. If you are building from 2nd Edition plans you must have newsletters 18 through 43. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 43. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 43. If you are building a Long-EZ you must have newsletters from 24 through 43. If you are building a Solitaire, you must have newsletters from 37 through 43.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
Last CP we announced that we would be testing the "new canard" in its "final configuration". Guess what? It did not do the job and we were ready to call it quits. John Roncz meanwhile was still working on the problem. He came up with a new airfoil that he felt would do all we wanted. We looked at his data and decided to give it one more try. We built the new canard and elevators, and flew it on N79RA, the prototype Long-EZ on January 16, '85. This fifth attempt was the charm. The new Roncz canard flies essentially identically in the dry and in the rain. RAF will be making a set of drawings available as an option to the

original GU canard. We have not started the drawings as yet as we need to do more evaluating of the new canard. Don't call us for information. We will have plans available by April 1, 1985.

We have been busy modifying a second Long-EZ for the Army, and the engine installation plans for the Defiant.

We are currently planning to fly Burt's Defiant to the Sun' 'n Fun flyin at Lakeland, Florida. Mike and Sally will be there from March 19 through March 23.

BURT'S WEDDING

As announced in CP 42, Burt was married to Margaret in Wichita, Kansas on November 16, 1984. It was a beautiful wedding with a large crowd of friends at the church and the reception. At the reception, we were treated to something very special, a piano solo by airfoil whiz, John Roncz. What a talent!

Burt arranged a tour of the Starship I manufacturing facility, the first public tour of the facility and it proved to be extremely interesting. Anyone who still thinks Beech may not be serious about building Starships is not thinking. The amount of money that is being spent on buildings, tooling, autoclaves, ovens and man power was staggering to behold. The quality of work being done on the six Starships presently under construction was outstanding.

Mike and Sally with two of the Scaled folks plus what seemed like tons of baggage took off from Mojave in the Defiant. Cruising at 11,500 feet at 175 knots true, and burning about 13 gph (total), they flew non stop to Farmington, New Mexico for lunch and fuel. From Farmington to Wichita, weather forced them up to 16,500 feet briefly then back down to 13,500 feet. With a little help from the west wind, ground speed for the trip worked out at close to 205 knots. Mike and Sally flew back alone with all kinds of room. Weather was IFR, so an instrument departure was made and they did not see the ground until they reached Albuquerque. A stop for lunch at Winslow and them home to Mojave. This was Sally's first cross country in the Defiant and she is now thoroughly spoiled by all the baggage room and the comfort of the Defiant!

LONG-EZ CANARD UPDATE

The standard Long-EZ canard if built according to the plans, is identical to the VariEze plans-built canard. On the Long-EZ however, there has been a history of what has become known as the "rain trim change". This trim change is usually a nose down trim change when flying into rain requiring a small aft force on the stick to maintain altitude, which is easily trimmed out, using the bungee trim system. According to feedback we have received from builder/flyers, this is what most pilots notice. For the average Long-EZ pilot, this is of course no problem, rather more of a minor annoyance and once you have experienced it a few times, you simply trim for the condition and press on. A few builder/pilots however, report that their Long-EZs exhibit a more pronounced nose down trim change, requiring most of the available bungee trim force to fly hands off and in a couple of cases, pilots report not having enough trim authority to trim "hands off". During the last two years we have spent a lot of time and effort to try to understand what causes this trim change.

Thanks to John Roncz (airfoil designer par excellence) we now do understand it and have the analytical tools to predict and to overcome this phenomenon. We have built and tested five completely different canards with different airfoils. Many flight hours have been flown and a considerable data base has been generated. Also, a video camera was used to document tuft behavior on each airfoil. The lift and hinge moments with and without rain were documented. A method to simulate the rain effect was developed. Surprisingly one airfoil had no rain trim change at approach or cruise speed but has a considerable reduction in max lift, resulting in a nose drop if rain were encountered in the flare. The result of this extensive testing was the data John needed to model the rain trim change in his computer program. Soon he was able to duplicate the flight test results on the computer and from there was able to produce a brand new airfoil, the Roncz 1145MS, which we have recently tested on the prototype Long-EZ, N79RA.

This completely new and never flown before airfoil is by far the best we have seen. It has a negligible rain trim and the rain only adds 2 knots to stall speed. Of course some more flight testing remains to be done, however, we are confident that we do indeed have what we have been looking for. The R1145MS produces considerably more lift than the original GU-5(11)8 airfoil, and in fact more than any we have tested so far. This enables us to reduce the span, reducing whetted area, and thus drag. The basic airfoil is also very low drag. Its trailing edge shape provides the correct stick forces without external devices.

At this time, the span from the outboard tip of the left elevator to the outboard tip of the right elevator is 130". This compares to 140" on the original GU canard. We have incorporated the John Roncz designed curled-up wing tips first seen on Mike and Sally's N26MS. These

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tips are specifically optimized to enhance the vortex coming off the tip of the canard and position this vortex in the "sweet spot" over each main wing. The remaining test and preparation/printing of the plans should be completed by April 1.

The new Roncz 1145MS canard will not be recommended for the VariEze. The airfoil used on the VariEze main wing, is working very hard to maintain attached flow even with the GU canard. This new canard may ruin the stall characteristics of a VariEze. Feed back from VariEze flyers indicates that while most VariEzes do have a small rain trim change, it is just that, a small trim change that in most cases is not significant enough to warrant the flight test program that would be required to qualify a new canard for the VariEze.

SUN 'N FUN
Mike and Sally will be flying Burt's Defiant, N78RA to the Sun 'n Fun this year. They plan on arriving March 19 and staying through March 23. They will bring a few sets of Defiant plans as well as other RAF items. RAF will not have a booth but Mike will give a Defiant talk on Thursday, March 21. Hopefully we will be able to impose on Johnny Murphy and Charlie Gray to help answer builder questions on the

Defiant. Of course, bull sessions at the airplanes will be conducted and we invite you to come and ask questions and share ideas.

The EZ Race, started several years ago by Steve Woods and Tim Gehres is being revived by Charlie Gray this year and is being called the "Sun 50 Airplane Race". The Sun 50 will be run on Wednesday, March 20. This race is an all out speed race of approximately 50 miles against the clock. The Sun 50 is open to experimental homebuilts, non racing type aircraft only. There are 3 classes, one of which is specifically for VariEze and Long-EZ. This is a fun race and should be very popular. Entries are limited to the first 35 airplanes. Call or write Charlie Gray, 398 Palm Drive, Oviedo, Florida, 32726. (305)365-2735. If you are interested, you will need an entry blank and a copy of the rules, so get in touch with Charlie.
Note - The EZ Builders of Florida Banquet will be held on March 22, Thursday, cocktails at 6:30 pm and dinner at 7:30 pm. The banquet will be at Sweetwaters Restaurant, 101 South Florida Ave, Lakeland. The tickets are $14.00 per person for either a mixed seafood dinner or a filet which includes salad, bread roll, beverage and dessert. Please contact Charlie Gray - Charlie needs to know by Monday the 19th of March. 305-365-2735.

DEFIANT NEWS
Fred Keller has been at it again, working hard on the engine installation plans and as we go to press, we are expecting to receive his drawings. We will correlate the drawings, add baffling templates as required and prepare the words, music and drawings for the printer. Usually it takes 3 to 4 weeks to get the prints back. So realistically we should have the engine section available for sale around the end of March.

We continue to hear from Defiant builders who are progressing at almost unbelievable speed. Dr. Yost, from Sheffield, Alabama has his fuselage on the gear, nose gear retract mechanism is installed and operating, wings are complete and mounted, the canard is complete, canopy and turtle deck and is building dynafocal engine mounts to mount his IO-320, 160 hp engines. We have been giving him information over the phone as he needs it to build the mounts. We would never have thought anyone would be this far along so soon!

Johnny Murphy is also working on engine mounts and has all of the major parts built. Hopefully we will see at least two new Defiants at Oshkosh, 1985.

A group of Defiant builders have gotten together in the general vicinity of Houston, Texas. They are comprised of 12 plans owners, with at least 3 of them going great on their projects. a group of builders like this really speeds things up, one jig works for everyone and shared knowledge of short cuts, sources for parts and even potential pit falls are all among the advantages of forming and maintaining a group.

1/5 SCALED LONG-EZ MODEL UPDATE
Four different model airplane magazines are doing "in-depth' reviews of the 1/5th Scale Long-EZ. Look for them on the newsstands. We read an article in March 1985, "Flying Models" by Nick Nicholson, who built and flies one, and for anyone interested in the model, this is an

outstanding article. The kit is really top class and easy to build. RAF has kits in stock for pick up or you can write to St. Croix Models, P.O.Box 279, Park Falls, WI 54552. (715)762-3226. Talk to Jim Schmidt.

HOMEBUILDER RESPONSIBILITY
Reading through Rex Taylor's "Dragonflyer" newsletter #17, we noted an excellent article covering homebuilder responsibility. We would like to reiterate on this because we believe that you the homebuilder should be aware of what you are taking on when you build your own aircraft.

The FAA has set up the Experimental Amateur built category (thanks mainly to EAA) to allow an individual to design, build and fly his own aircraft. The FAA lists that individual as the manufacturer. As the manufacturer, the builder is entirely and totally responsible for that aircraft. The builder has passed judgement on the quality of workmanship and he alone has made the decision that each and every part that he has put into that aircraft, is in his opinion, airworthy.

A lot of builders are under the mistaken impression that the FAA inspector will guarantee that the aircraft is airworthy when he inspects the aircraft and issues a airworthiness certificate. The FAA does not decide your aircraft is airworthy, you do.

For this reason, every builder should become involved with the EAA. Join your local EAA chapter. Attend their monthly meetings, talk with other EZ builders. Many good books are available from EAA. Supplement your plans with a few, such as Tony Bingalis' "Firewall Forward". After you have got something built, get as many people as you can, to look over your work. Don't be embarrassed. If someone critiques your work, take a strong look at it. If it is not right, throw it out. Your best assurance of success is to adhere strictly to the plans and to build it from the correct materials. In order to be positive that you are using the correct materials, buy them only from the recommended suppliers.

The same philosophy is also true for engines. Almost daily we receive calls or letters from builders wanting to substitute some wizz-bang engine for the recommended one. RAF can not ethically recommend an engine we have not installed and tested. For the Long-EZ we recommend any model of the Lycoming 0-235. If you wish to install some other engine, please do not call us. We can not help you. As an experimenter, you can of course, use any engine you want to. You should be aware that you will be involved in redesigning engine mount structure, cooling may not be adequate and you will be testing an unknown when you fly your airplane. You should expect surprises.

If you want a reliable cross country airplane, do yourself a favor and buy a real aircraft engine such as a Continental or Lycoming. These engines have literally millions of hours of field testing on them and have a proven record of reliability.

You the builder have the sole responsibility to produce a safe, reliable aircraft. Take that responsibility seriously. The bottom line is this: The designer has absolutely no control over what material, power plants, etc. go into your aircraft. No control of quality of workmanship and no opportunity to inspect work or materials

and therefore cannot be responsible for your actions. Most designers will do everything in their power to ensure your success with one of their designs, since problems are just plain bad for business. The best advertisement for the designer, is an airplane that does what the designer said it would and a builder/pilot who is happy with what he builds.

Learn to Fly in a Long-EZ?
Dick Prentice built his Long-EZ as a non-pilot with the intention of using it to obtain his pilots license. Dick built his Long in the San Diego area, a hot bed of EZ activity. When it was complete, he trucked it to Brown Field, where VariEze builder/pilot, Al Coha did the first flight in May 1984.

Dick installed a throttle, mixture and push-to-talk transmitter switch in the back cockpit. He found an excellent instructor who was very interested in the Long-EZ who gave him dual, soloed him and signed him off for his cross countrys and night flying. Ultimately Dick was signed off for his private check ride, when a possible stumbling block was thrown at him. The FAA could not decide if Dick should be issued a restricted license, since he had not done any stalls! After some hassling around, Dick decided to end the problem by renting a Cessna 152 for 1 1/2 hours. During this time his instructor put him through all the required stalls and finished up his night flying requirements. He took his private check ride in his Long-EZ and received a normal private pilot certificate.

This is the first case we know of, of a builder obtaining his pilots license in his own Long-EZ. Congratulations Dick! Dick would like to give credit to his wife, Joy, who was the driving force behind getting the Long-EZ built and who is now taking flying lessons in their Long. He also wants to thank the EZ Squadron in San Diego for all their help and encouragement.

VARIEZE VORTILON UPDATE
We are very pleased with the positive feed back we have received from VariEze pilots who have installed the vortilons per CP #42. Steve Sorenson writes:
"Dear RAF,
I wanted to give you a testimonial for the new vortilons I installed on my VariEze. I installed them exactly as per the plans in the last Canard Pusher except I used super glue instead of epoxy or silicon. As you know my airplane has never had wing cuffs and I have always found the airplane extremely stable and easy to fly despite the wing rock at full aft stick. As a result I was a little skeptical about the performance improvements promised by the use of the vortilons but I figured I should try them since they wouldn't take much time to make and install. After having flown the plane now about 8 times with the vortilons, I am sold on them. I found that the wing rock at full aft stick is completely gone and I can now do any maneuvering I want at full aft stick without departures that I would occasionally get before. The biggest improvement, though was the stability improvement in the landing pattern. I have always flown final approach at about 90 mph or a little higher if I had a passenger. I could fly at 80 when lightly

loaded but I got a high sink rate that was a little uncomfortable and gave me much reduced visibility over the nose. With the vortilons, I can very comfortably fly final at 80 mph, even with a passenger and have full control and a reasonable sink rate. The result is that I can now make the 1000 foot turnoff on the runway at my home airport, something I could never come close to doing before. I haven't noticed a significant increase in climb performance, but I haven't done any real tests of that yet. In short, I am sold on the vortilons and would recommend them to all VariEze pilots.
Steve".

Jerry Gardner was up at RAF last Saturday and claimed that after making over 1000 landings in his VariEze, now that he has vortilons, he is having to learn to land his airplane all over again! The glide is better, power must be reduced further out and visibility over the nose is much better during both take off and landing.

Gary Hertzler writes, "I tried 'em, I like 'em! Everyone should try them, in a word "fantastic".

If you have not yet tried them, do, even if you temporarily "Hot Stuff" them on. You will be glad you did.

NOTE: A few dimensions were omitted in the last CP. The value of "X" (top left) is:
at B.L. 81.6 "X" is 0.3"
at B.L. 102.7 "X" is 0.25"
at B.L. 122.4 "X" is 0.2"

These dimensions are not critical and if you made accurate copies of the full sized drawings of each vortilon, they will in fact fit at the appropriate B.L. with the above dimensions or very close.

We would appreciate feed back from the VariEze builder/flyers who install and fly the vortilons. Look for better visibility over the nose during take off and landings due to lower deck angle, better glide performance and better climb.

FOR SALE

Lycoming O-235-L2C, runout 2400 hours since new. No damage. Complete except for carburetor, with logs. $3000.00.
Contact: 714-241-1809

Lycoming O-235-C1, 115 hp with all accessories including primer lines. 40 hours since major. Super clean, removed for more power. $4000.00
Contact: Bob Orhletz
714-681-4488

Lycoming O-320-E2G, 2542 total time, 485 hours since major. Firewall forward, $2800.00
Contact: Gene Croghan,
Great Falls, MT
406-761-7346

Lycoming O-235-C2C, zero since major by A & P. 1900 total time. All accessories, mags, starter, alternator, carburetor, fuel pump and vacuum pump. Includes logs. $4850.00/or best offer.

Contact: Doug
805-824-4541 (work)
805-824-4860 (home)

Marvel Schebler float kit, P/N666-915 for MA-3 and MA-4 models. $72.50.

Contact: Bud Gross
619-365-8492

Narco Escort II, 720 Comm 200 nav, in one 3 lb package. Fits into a standard 3 1/8" diameter instrument hole. For a limited time only, factory fresh from Narco, delivered for $1149.00 (plus tax in Texas).

Contact: Chuck Jordan
502 E. Huitt,
Euless, TX 76040
817-267-2840

NACA air vent door for VariEze and Long-EZ. Simple, light weight, only minutes to install. $6.00 each plus $0.50 postage and handling.

Contact: Gene Zabler,
48 Robin Hill Drive,
Racine, WI 53506

WANTED
VariEze Prefab fuel strakes and cowling for Lycoming. Sell or trade Bendix mags for Slicks.

Contact: Tom Wilson,
2643 Amy Court,
Duluth, GA 30136
404-476-3264

Wanted space to share to build Long-EZ. Long Beach area.

Contact: Doug Domurat
714-642-3910 - day
213-549-9497 - evening

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of

recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

VariEze - The
X' dimension for the vortilons was omitted on Page 6, CP 42.

B.L.	'X'
81.6	0.3"
102.7	0.25"
122.4	0.2"

VariEze and Long-EZ - Landing Brake.
A few builders have reported noticing a softening or weakening of their brake. We checked ours here at RAF and sure enough, when we wiggled it fore and aft we could feel and "hear" the damaged urethane foam "working". The glass of course was not damaged and no builder has reported any more damage than this. This repair should be done within the next 25 hours.

The landing brake is called out to be made from urethane foam. Anyone who had not built the landing brake, should build it from PVC (Klegecel of Divinycel) 3 or 4 lb/cubic feet foam. Increase the length of LB19 (plywood insert) by 1 1/2" and taper it as shown to reduce the concentrated loads at the end. **SKETCH OMITTED**

If you have already built your landing brake or are already flying, an appropriate repair/reinforcement is as follows: drill several 1/16" or 1/8" diameter holes through the skin below (or aft) of LB19 plywood insert. Inject pure epoxy or a very liquid slurry into each hole, forcing the slurry/epoxy into the damaged urethane foam. When this cures it will greatly stiffen this area of damaged foam. Remove the LB18 brackets and layup 4 plies of UND over the plywood insert and down the inside skin of the landing brake as shown.
SKETCH OMITTED

Long-EZ

LPC #119, Section I, page 14-7, parts #LWA4 and LWA5.

Increase the size on 8 LWA4 from 1 1/2" x 2" to 1 3/4" x 2" and on two LWA5 from 2" x 2" to 2 1/4" x 2". The increase is in the vertical dimension and is to allow more leeway when drilling the 5/8" wing mounting holes. Several builders have come very close to the edge of these parts, a couple have actually broken out. Breaking out is cause for rejection.

LPC #120, Section IIL, Page 6, 2 paragraph. There should be 4 AN509-10R8 screws in each top attach point. LPC #100, CP32, page 7 incorrectly called this out as 3 screws.

Defiant

DPC #22, MEO
Page D-38. Fuel sump tanks should have a nylon float switch (fuel warning system, sensor $26.00, light $6.10, Aircraft Spruce catalog, page 121) installed in the side of each sump tank near the top of the tank, such that when your main tanks are empty and you begin to use fuel out of a sump tank, it will trip the float switch and light a red warning light on the panel. This alerts you to the fact that you are down to sump fuel, approximately 4 gallons, which you can accurately monitor on your electric fuel gauge.

DPC #23, MEO
Bill of materials. You will need a piece of 4130N steel, .040 thick x 6" x 12" for various small steel parts.

Solitaire Plans Changes

SPC #52
Section I, Page 2-2. Bill of materials, add 4 each CS-201 to the parts call out. Order from Ken Brock Mfg.

Solitaire Builder Hint

We have not called out the exact clearance between the ends of the control surfaces and the wings. Set the clearance to 0.1". Do not try to fit the control surfaces closer than this because under high 'g' loads with lots of bending on the wings these could bind. Another consideration is flight through rain into freezing temperatures which could freeze up the controls.

We had a builder write and tell us he did not have the required clearance on the aileron belcrank, page A-23, view H-H. He extended the pivot bolt and put some washers above the bellcrank to get the 0.2" clearance on the pushrod belcrank bolt as called out in the plans. You must have the required clearance here, do not short cut this dimension.

When you are installing the control system we have had complaints that the holes in the F.S. 22.5 bulkhead are too small to reasonably assemble the elevator bolts. It is acceptable to open these holes up to a 3" diameter.

DEFIANT PROPELLER INFORMATION
Based on our considerable experience with wood props, we have designed a prop extension that Ken Brock will be manufacturing and selling to Defiant builders, that is optimized to reduce or eliminate many of the

problems associated with wood props. This extension is 8" long, a length required to fair the engine nicely. The flange that bolts to the engine is standard. The flange that the prop bolts to is 7" in diameter, 1" larger than standard. The crushplate also is 7" in diameter and 1/2" thick in order to be able to spread the local force exerted by the bolts. This additional 1" of diameter gives us approximately 20 square inches more area to drive the prop. Also the threaded drive lugs are 3/4" diameter instead of 5/8" and are threaded for 1/2" x 20 bolts instead of 3/8". This allows us to torque the bolts to 375 to 400 inch lbs. (instead of 220 in/lb) without crushing the wood. We have tested this system on the O-320 as well as the O-360 engines with excellent results.

These prop extensions are the only RAF recommended prop extensions for Defiant. We have informed the prop

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manufacturers of this change which requires a larger prop hub, and 3/4" countersunk holes. Of course, if you use constant speed props, none of the above is applicable.

Mooney Nose Gears for Defiant.
Caution: Old gears can accumulate considerable rust in the weldment. Careful inspection is required to be sure you have a good one. Note that you need the entire Mooney nose gear from the fore/aft pivot down. This includes the vertical steering pivot. You do not need any retract parts from the Mooney.

BUILDER HINTS
VariEze and Long-EZ - Hot Stuff model airplane "instant" glue. A cyanoacrolate glue, Hot Stuff can be extremely handy to "tack" pieces in place, to essentially give you a third hand, by almost instantly glueing small parts and firmly holding them in position. Hot Shot, a spray accelerator that speeds up the curing time of Hot Stuff glue can also be used to great advantage. We like the thick glue as opposed to thin, and when used with Hot Shot accelerator, can produce an unbelievably strong bond between glass pieces, plywood or even PVC foam pieces (do not use on Styrofoam). We have tacked winglets to wings with Hot Stuff, instead of Bondo. The advantage is, it cures instantly and you can layup glass right over the tiny drops of Hot Stuff. We also have found it a great time saver when jigging parts. Experiment and you will find all kinds of places you can use this material.

HOTWIRE TEMPLATES - VariEze and Long-EZ - We have found that the best material to make hotwire templates is from 1/16" thick phenolic. This is readily available from Aircraft Spruce or Wicks. The next best material is formica, then 1/16" or 1/8" aircraft birch plywood, then possibly 1/32" aluminum.

Glueing the paper template to the phenolic, formica or whatever you use, should be done with Safe-T-Poxy or a quality glue that does not shrink or distort the paper. A better method is to use carbon paper over the phenolic, and trace the airfoil through the carbon onto the phenolic. Using a french curve and a sharp, hard pencil, you can produce a very accurate template, with no distortion and still have the

original paper template for reference. Just be sure that the phenolic and the paper template can not slip relative to each other. Masking tape will position them securely.

VariEze and Long-EZ - Nose gear chattering.
George Dyer is a gear expert and we sure appreciate this excellent hint.
"The following procedure will reduce and in most cases eliminate the chattering of the nose gear during lowering and some reported cases of inadvertent lowering in flight during turbulent weather conditions. This condition is caused by the weight of the nose gear wheel assembly pulling the gear housing arm (NG50) and causing it to over run the speed of the rotating worm gear (NG58) during lowering. An axial thrust load on the low speed shaft (NG52) will resist the weight and over running condition. The nose gear housing sides (NG51) and (NG30) are considered a flexible gear housing and require a greater axial thrust load present on the low speed shaft (NG52) than a rigid gear housing to eliminate the low speed gear (NG53) over running the worm hear (NG58) during lowering which results in a chattering sound. This can eventually result in gear fatigue.

To accomplish the axial thrust load, washers (AN960-1016), regular or light thickness, need to be added on the low speed shaft between the NG55 spacer and the NG53 bearing as required to achieve an even clearance of .030" to .060" at points A and B shown on figure #1. Clearance should be set before the gear housing is installed in the plane since you will be unable to determine the thrust load clearance when installed.

Both bearings (NG54) should be lubricated with a grease type lubricant before installation.

If there are any questions or problems, please feel free to give me a call or write: George Dyer, 6221 Chapman Ave, Garden Grove, CA 92645, 714-894-6448". **SKETCH OMITTED**

Long-EZ - Builder feed back indicates that most builders are finding that they need more epoxy than what is called out in the plans. Keep this in mind, and when you order your epoxy, order only what you think you can use in the next 12 months. Be realistic with yourself, there is no sense in buying 15 kits of epoxy, using only 5 in the first year and being stuck with 10 kits of out of date epoxy. The manufacturer has put a 12 month shelf life on the Safe-T-Poxy. You are the aircraft manufacturer and you have to be responsible to make the right decision when a primary structural material goes over its shelf life. Stay away from this problem by buying only as you need, keeping only fresh epoxy to build the structure of your aircraft.

VariEze, Long-EZ and Defiant - Glueing hotwire template paper material. Punch a few holes through the paper along and on the waterline. Draw a line with a straight edge on your phenolic, formica or plywood template material. Now it is easy to line up the water lines since you can see through the paper. This also helps prevent warping or distortion of the glue soaked paper.

VariEze, Long-EZ and Defiant - Trimming and squaring foam blocks can be done quickly and accurately if you take a couple of carpenter squares

and drill nail holes every inch or so. Nail the squares to the foam and use the square as the hotwire guide. This works great, especially if your work table is flat.

VariEze, Long-EZ and Defiant - Drill a couple of tiny holes through your hot wire templates right on the W.L. and put a couple of small brads part way through the templates. This allows you to rest your level on the brads, assures that the level and the W.L. are correct to each other, and the short point of the brad sticking through the template helps hold the template temporarily in position on the foam block without slipping until you can nail it in place.

CAUTION
A possible 'bad' batch of Safe-T-Poxy hardener may be out in the field. Only two reports have been received to date. Symptoms are slow curing or no cure at all. Be sure and ALWAYS check yesterdays mixing cup with the classic scratch test. 24 hours after mixing epoxy in a cup, the surface of the residue can be scratched with a sharp object, such as a pocket knife or a nail and this scratch should look white and the cured surface should not feel gummy. Do this test 24 hours after every layup. This is the same test that is used throughout the industry and will guarantee that you never use a bad batch of epoxy. It will also show up a poorly mixed batch or a batch mixed using an incorrect ratio.

CAUTION
Paul Prout's fuel sight gauge as advertised in previous CPs should not be used with auto gas. Av gas is no problem at all and the pair installed in N26MS over a year ago have worked perfectly using only av gas. Paul is working on a auto gas option, but until then no auto fuel in Paul's sight guages.

CAUTION - Aileron to Wing Clearance on Long-EZ and Defiant. With the ailerons in the neutral position, the gap between the lower leading edge of the aileron and the trailing edge of the wing should be a minimum of 1/8". Pay particular attention to this at the outboard end of the aileron. You may have nice free moving ailerons, static on the ground, but when the wing start to carry the load and bend, this clearance actually closes up a little. This is a point to inspect if you have an airplane flying. Look for worn spots in the paint.
SKETCH OMITTED

Lycoming O-235 Main Bearing Oil Seals
We have had two reported cases of these seals blowing out and falling into the cowling. This is a serious situation, which in one case resulted in an off-field landing with considerable damage to the airplane. At least one of these occurrences was the result of the wrong seal being installed. The O-235 crankcase is machined with retainer groove as shown. **SKETCH OMITTED**

The correct oil seal (Part #LW13792) has a corresponding retaining "lip" that should 'pop' into the groove in the case. The Lycoming O-320 seal does not have this lip to mechanically retain the seal and it could pop out if inadvertently installed in an O-235. Oil seals do occasionally come out but it is rare, according to Lycoming. When they

do, it is generally because the breather has become blocked or restricted, or the wrong seal was installed, or the retainer groove in the case had become caked and filled with old permatex and was not cleaned out properly prior to installing the new seal and of course the new seals 'lip' was not able to snap into the groove.

The best way to install these seals is to thoroughly clean the inside of the crankcase where the seal will go with MEK solvent. Use a bent wire or small screw driver to clean out the retaining groove. Don't neglect the crankshaft. It should be cleaned and polished where the seal will be. Clean the new seal thoroughly with MEK as well. Use Goodyear Pliobond (contact cement) and paint the seal and the inside of the case with two coats (allow the first coat to tack). Press the seal into the case while the Pliobond is still wet, and do not run the engine for at least 24 hours.

Carefully check your breather system. If you have an oil separator, be sure that there is no restriction in the line. Check that your plastic breather line is not kinked or folded over. Be sure this cannot occur once everything gets hot. It is very important that the breather line is kept open and clear so that no pressure can build up in the crankcase.

VARIVIGGEN NEWS

Wayne Wilkins flew his first flight in his Viggen on November 29, 1984. Congratulations Wayne!! Nine years is a long time to work on an airplane, but Viggens don't come easy! To the best of our knowledge, there have been eighteen VariViggens completed and flown. Viggen pilots are really quite a select group. Frank Stites visited RAF recently and he reports that his Viggen is flying well, but that bad weather at this time of the year was making it difficult to put many hours on his Viggen.

Sally and I have decided to donate our VariViggen, N27MS to the Museum of Flight in Seattle Washington. There are many reasons for this decision, but the main one is that the airplane is not flown very much any more and we just hated to see her rotting away in a hangar. We decided against selling the her due to the liability. The Museum of Flight is a relatively new museum and they have expressed a desire to display our Viggen, which would assure that it is preserved for everyone to enjoy. N27MS was started in August 1974 with first flight being on September 22, 1977. She has always flown very well and has been extremely reliable over the past 7 years. She never failed to get us where we were going or to get us back.

The only problems we had with her were a few minor electrical (alternator) problems. Almost 650 hours of fun flying and many unforgettable trips are over. It was a tough decision, an emotional time but we have decided and N27MS will be delivered to the Museum of Flight in Seattle in April, 1985.

Of course this does mean that RAF will not be able to do any more pilot checkouts for Viggen builders. Hopefully one or more of the currently flying Viggens could help out in this area. The Viggen Club, a group of 39 active Viggen builder/flyers/fans, is still quite active and is the source of moral support and information sharing.

The VariViggen is the airplane design that started the whole canard revolution and will always have a special place in history. Anyone tenacious enough to complete one will be a member of a very special group - Viggen builder/pilots.

SHOPPING
Aircraft Spruce and Wicks Aircraft are now carrying the essential Solitaire kits. This kit is made up of the fuselage shells, main wing spars with fittings, canopy in the frame, turtle deck and seat pan. Please contact the distributors for prices.

At Oshkosh we received many requests for the white polo shirts that we were wearing. We now have these in stock. They are white, three button with pocket, polo shirts. At this time we have them with the Long-EZ with "Rutan Aircraft" under the plane. The shirts are a good Hanes quality. Cost is $14.00.

We have the second edition of the "Complete Guide to Rutan Aircraft" by Don and Julia Downie in stock. Cost $13.50.

We also have the book "Canard" a Revolution in Flight" by Andy Lennon. Cost is $17.95. This is a history of the canard.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dick and Joy Prentice with the Long-EZ they built and learned to fly in, N93DJ.

Buzz Talbot and Mr. Gooch, partners on their Long-EZ, N112TG. Note the 720 channel "Becker" comm radio on the right. It fits into a 2 1/4" hole!

Jimmie Dallas' newly completed VariEze, N3976D. Jimmie flies out of Anderson, Indiana.

G-IVAN, Ivan Shaw's gorgeous VariEze, seen here at the Popular Flying Association Flyin in Cranfield, England.

Dick and Joy's instrument panel.

Captain Peter Magnusun flying his Long-EZ. When he is not flying the Long, he flies an Electric Jet, (F-16).

Phillip Wessel, Scottsdale, Arizona carving his Long-EZ fuselage.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dr. Yost and friends jigging main wings to centersection spar on his Defiant.

Dr. Yost's Defiant is on the gear and the turtledeck and canopy section is hung up in the ceiling ready to mount!

Nose gear retract mechanism in Dr. Yost's Defiant. Very nice workmanship.

Charlie Gray, working on his Defiant, but remember Charlie built two Long-EZs! Nice shirt Charlie!!

Michael Marks and builder assistants trying it on for size. I guess we all fly 'em around the yard before we get done, we certainly do at RAF!

Dr. John Steichen, Defiant builder in Downers Grove, Illinois had his fuselage in the jig. John reports that so far, building the Defiant has been easier than building his EZ, N27EZ. John started construction on Serial #13 on Sept. 1, '84.

DEFIANT
HOMEBUILT
FOUR-PLACE
TWIN

Introduction
For some time you have been reading about the four place, push pull twin engine Defiant. After five years of enjoying a "one of a kind" aircraft, Burt Rutan has made the decision to release Defiant drawings to the homebuilder. In late 1981 Burt contacted Fred Keller of Anchorage, Alaska and asked if Fred would be interested in building a Defiant and keeping a complete log with updated drawings and photographs as he was building. Fred agreed and at the EAA convention in Oshkosh 1983, Fred's Defiant was on display. Some changes have been made to the original aircraft such as, an increase in span on both main wings and canard and a revised aileron for lighter control forces. The back seat folds forward for a `station wagon' effect that allows two people to use the baggage area for sleeping. The canopy opening has been improved for easier entry. The fuselage has been changed to allow more head room for the back seat passengers.

Fred Keller is now completing the detailed plans for the Defiant. These will be available from RAF in March 1984. The builder support will be from Fred for plans interpretation, and from RAF for general `how to' on the construction.

Description
The Defiant is a four place, canard-type twin with two 4 cylinder Lycoming engines. Engine power can be 150, 160 or 180 horsepower per engine. It's canard configuration provides several important benefits as compared to conventional twins; (1) Packaging is considerably more efficient - it has a standard-size cabin in an airframe whose whetted area is only 60% that of a conventional light twin. (2) The smaller airframe also has reduced structural load paths allowing a structure much lighter than a conventional twin while having better durability and a higher `g' capability. (3) The tandem wings allow natural aerodynamic angle-of-attack limiting, thus, the airplane is stall

resistant. (4) The tandem wings, using winglets for directional stability provide a 30% reduction in induced drag compared to a conventional aircraft with the same span loading. (5) Flight control systems are simpler and lighter. Elevators are only two feet from the control sticks and they provide a flap effect without having separate flaps, thus, at low speed the canard has a deflected full span slotted flap, yet the pilot has no flap control to adjust.

The rudder is only one foot from the pilot's rudder pedals. It is designed to provide control, yet have no effect on stability. Ailerons on the aft wing are controlled from their inboard end such that the entire wing and vertical fin assembly is built without any moving parts.

The small chord elevators and ailerons allow control forces compatible with a side-arm control stick. This allows more precise, less fatiguing control and provides improved use of primary instrument panel space.

Instead of the complex electrical system with one buss and battery tied to two alternators, the Defiant has two simple separate electrical systems, each with its own battery and alternator. IFR avionics are split to both systems so that no single failure can effect essential equipment. Both engines can be started simultaneously. The two systems can be tied together to run all equipment from one alternator in the event of a failure. Also, a low battery can be charged by the other engine without ground electrical equipment. Thus, the electricals are much like conventional fuel systems, i.e., completely independent but with "crossfeed" available in an emergency.

The fuel system consists of a 58-gallon tank with a large sump for each engine. The two systems are independent and require no pilot action for normal operations. Crossfeed is available. The sumps are accurately gauged and are equipped with low level warnings, such that when 45 minutes fuel remain the pilot not only has a warning light, but has a gauge that moves full scale for the last 45 minutes fuel. He can then intelligently plan his options when fuel is low, knowing quantity to within 1/3 gallon of fuel. The last one half gallon of fuel can be used in all normal attitudes. While appearing small outside, the Defiant is quite roomy inside. It has a cockpit width at the elbows of 46 inches (43 inches at rear seats). Knee and leg room for the backseats is a full eight inches more than current light twins. The Defiant has a large baggage area aft of the back seat and even larger if the back seat is layed flat. Two six foot people could use this area to sleep in. The unique semi-supine seats provide a significant advantage in comfort over conventional seats. With a conventional seat, the upright pilot carries all his weight on the buttocks and small portion of the thigh. The Defiant's seat is reclined a full seven degrees more and armrests and headrests are provided for all seats. Thus the body weight is distributed over the lumbar, forearms, thighs and head, rather than being concentrated in the tailbone area. In general, a person who normally finds himself fatigued after a two to three hour flight, will be comfortable even twice that long in a well supported reclining seat.

The side arm controller and throttle system places the pilot's arm in a more natural position while flying and frees his lap area so he can use

an airline type lunch tray for maps, approach plates, computers or lunch. Space efficiency and panel visibility is considerably increased when the control wheels are eliminated.

The aircraft is very basic in its systems. It will never require maintenance nor have an AD issued on its flaps, retractable main gear, cowl flaps, governors, hydraulic system, oleos, stall warning, nor emergency gear extension system, since these were eliminated in the basic design. The remaining systems (flight controls, power plant installation, electrical system, fuel system, etc) are all very basic and simple compared to the conventional light twin. This saves weight, reduces maintenance and increases availability and reliability.

Visibility, particularly in the pattern, is superior to current light twins. The canard wing is at approximately the same height as the nacelles on a Seneca II. Forward downward visibility is adequate over the canard during normal climb, approach and landing flare. Absence of a wing above or below the cockpit area results in a welcome improvement in visibility over conventional aircraft.

Flying Qualities
Flying qualities are conventional with the following exceptions: (1) Spiral stability is positive and speed stability is high, such that the aircraft flies "hands off" indefinitely once trimmed, even in turbulence. (2) There are no pitch or roll trim changes due to configuration or power. Once trimmed at approach speed it will hold that speed hands off during power changes and landing gear extension. The airplane is very stiff in yaw with high damping. Yaw oscillations damp in one to two cycles after a side slip release, as compared to three to six cycles for a conventional light twin. Roll rate is excellent. Adverse yaw is low enough that all normal maneuvering can be done with "feet-off-pedals" resulting in less than one-half-ball yaw excursions.

The Defiant is a very stable IFR platform with a very solid "big airplane" feel. It holds a desired approach speed with less attention than a conventional light twin.

Performance
In general, simplified systems means reduced performance. Not true for the Defiant. Overall performance and efficiency is significantly better than conventional light twins. Data discussed below are for 160 BHP engines. Time-to-climb to 12,000 feet is 10.3 minutes with full fuel and four adults and 7.7 minutes with two adults and 400 nm fuel. At maximum cruise speed of 184 knots (75% power), total fuel flow is only 17.8 gal/hr giving a 1.74 nm/lb economy and a range of 1044 nm with reserves. At 55% power (168 knots) total fuel flow is 13.9 gal/hr giving 2.00 nm/lb economy and a range of 1208 nm with reserves. At low cruise (40% power, 150 knots) range can be stretched to over 1300 nm with reserves. At equal loading and speeds, Defiant gets over 50% more miles per gallon than a conventional light twin! Holding capability is also impressive. At medium weight Defiant can remain aloft on only 40 thrust horse power (64 brake hp) for a maximum endurance of over 14 hours. The excellent two-engine climb capability allows cruise

altitudes as high as 18,000 feet with 4 adults and full fuel. The prototype has climbed above 28,000 feet at light weight, single place. This climb capability is far in excess of similarly equipped light aircraft. (Fixed pitch prop and no turbocharger).

Single Engine Capability
In contrast to all other light twins, in which after engine failure a many-step procedure must be accurately followed during which aircraft control and airspeed control are critical, the Defiant makes no demands on the pilot to follow procedures. He can even use any excess airspeed over the minimum full-aft-stick speed to zoom over an obstacle. Once over the obstacle he can maintain aft stick and climb away (single engine) or accelerate without altitude loss to best climb speed. This unique capability is best shown by comparing the Defiant's takeoff profile with that of a conventional light twin (figure I). Both airplanes are at maximum gross weight. Both aircraft experience failure of the critical engine at 10 foot height. Neither aircraft can land and stop in the remaining runway, so they must continue the take off. The conventional twin pilot must immediately do the following: (1) raise gear (2) identify failed engine (3) retard throttle on failed engine (4) cutoff mixture on failed engine, (5) feather failed engine, (6) bank five degrees toward operative engine, (7) carefully raise flaps, (8) Maintain 82 KIAS to 50 foot altitude. After 50 feet (accel-go procedure) he accels to best angle of climb speed (95 knots) and thus, does the best he can do to clear any obstacles. Height-distance profile for this is shown as the lower line in Figure I. Note that even though his eventual climb gradient is adequate (193 feet per nautical mile) the 310 is nearly 4500 feet from brake release before reaching the 50 foot height, and that unless airspeed control and procedures are accurate he will likely crash during this climb segment.

The 310 is one of the best light twins to perform this profile. The "light-light" twin types will either have less performance or will strike the ground during segment A.

The other lines on Figure 1 represent the performance obtained by the Defiant for several conditions. The lower lines are obtained if the pilot elects to fly at the best single engine rate-of-climb speed. Note that if the pilot does nothing but maintain airspeed he will clear the 50-ft obstacle at 3300 feet, even with the gear down.

FIGURE 1 OMITTED

The upper lines on Figure 1 indicate an even more interesting capability of the Defiant. Suppose a tall obstacle exists at the end of the runway. The Defiant pilot can pull back the stick to zoom over the obstacle, even slowing to his minimum speed of 65 knots. After clearing the obstacle he can merely hold the stick aft and safely climb away even if he leaves the gear down (no procedure). If any conventional light twin attempts this, an accident will result, since, they cannot climb when near min control speed or stall speed. If desired, a standard rate turn can be initiated following an engine failure during lift off at gross weight.

Specifications and Performance
(with 160 BHP engines, fixed Props).

Engines (2)	Lycoming 0-320
Seats	4
Basic Empty Weight	1600 lb.
Equipped Empty Weight	1680 lb.
Equipped useful Load	1270 lb.
Gross Weight	2950 lb.
Fuel Capacity	115 gallons
Span	31.4 feet
Wing Area	133 square feet
Wing Loading	22.2 lb/square feet
Power Loading	9.2 lbs/hp
Payload with full fuel	660 lbs.
Max Cruise (70%)	184 knots
Fuel flow at max cruise	17.8 gph.
Range at max cruise (45 min reserve)	1044 nm
Economy Cruise (55%)	168 knots
Fuel flow at economy cruise	13.9 gph.
Range at economy cruise (45 min reserve)	1208 nm
Climb Rate (2950 lbs)	1500 fpm
Climb Rate (2220 lbs)	1900 fpm
Single Engine climb (2950 lb)	310 fpm
Single engine service ceiling (2950 lb)	6500 ft.
Single Engine Climb (2200 lb)	550 fpm
Stall Speed (2950 lb)	64 knots
Stall Speed (2200 lb)	58 knots

Cost and Time to Build the Defiant
The cost of the materials list has not been completed at this time, but we estimate the cost of building the Defiant will be approximately "two Long-EZs", between $20,000 and $30,000. Remember that avionics can cost you as little as $1000 or as much as you wish to pay.

Time to build the Defiant, again will be "two Long-EZs" as it is the same type of construction, just more. A competent builder can build a Defiant in as little as 2000 man hours. Until the plans are completed, it is difficult to say how many of the parts will be available prefabricated and this would make a difference to the time to build.

	U.S.A.	Overseas
Canard Pusher Newsletter	$ 6.75	$ 8.75
Defiant Plans - Section I	$490.00	$510.00
Defiant Engine Installation . . .	not available at this time.	
Defiant Owners Manual	not available at this time.	

SOLITAIRE -
A
Self-Launching
Sailplane

THE PROBLEM

For a long time soaring has been an exclusive sport requiring a special license and training. Soaring in a glider of enough performance to allow the average pilot to feel the true thrill of 'engineless' flight has been expensive enough to severely limit the number of people who enter the sport. The current interest in ultralight and light sport aircraft has reached an all-time high.

THE CHALLENGE
The Soaring Society of America recognized the problem. Other segments of homebuilt aircraft were experiencing great interest and activity on the part of designers and the general public. The sailplane market was not getting its share of the attention. To correct this, the SSA issued a challenge in the form of a contest. Develop a self-launching sailplane capable of take off and the ability to climb to altitude without the use of a tow plane. The new design could be flown without the special license required of a sailplane pilot, just a private pilot's license. The aircraft must be easy to fly, as well as quick and easy to build. Strict rules were set up and an actual structural test of the finished aircraft was required. The Solitaire was designed around these goals and achieved these and more.

THE WINNER
At the flyoff held in Tehachapi, California, on September 6, 1982, the judges studied the entries, flew the SOLITAIRE and unanimously declared it the winner.

WHAT
The SOLITAIRE is a single-place self-launching sailplane that is fitted with an engine package that folds into the nose of the aircraft after it pulls the SOLITAIRE to soaring altitude. With the engine folded, it has a L/D of 32 to 1 giving it true soaring capability. The engine can be deployed and restarted inflight using its electric starter. The canard concept results in high resistance to inadvertent stalls and spins. Its 'spoilflap' descent control system has been acclaimed as "excellent" by all evaluators, providing crisp, variable glide path control without trim upsets. Unlike conventional sailplanes the pilot sits within the allowable cg range.

HOW
The SOLITAIRE uses the proven materials and methods pioneered by Burt Rutan and used in the VariEze and Long-EZ, two of the most successful aircraft ever designed for the homebuilder. The wings are special uni-directional fiberglass cloth and epoxy resin. They are built using the moldless composite technique developed in the VariEze and consist of prefabricated 'S' glass spars and a solid foam wing core. The fuselage comes as two prefabricated halves. The bulkheads are available prefab and the wooden fixtures and templates will be available premanufactured. The canopy comes installed in the frame and the turtle deck is available prefabricated. All of the metal parts and complete landing gear components are available premachined. The premolded parts are of aerospace quality. Construction consists of prepreg skins with a honeycomb core and an adhesive film to bond them together. These are then vacuum bagged and cured in an oven. In short, this aircraft will have more prefabricated parts than any previous design from Rutan Aircraft Factory. Of the available prefabricated parts, the builder can buy all or as few parts as he wishes. We estimate that an average builder, purchasing all the

available parts could build the aircraft in 400 hours at a cost of between $7000 and $9000. When the quality of parts and the ease of building is considered the value of the SOLITAIRE becomes apparent.

SUPPORT
Rutan Aircraft Factory support has been a key factor in the history of success with homebuilt aircraft. When you buy plans, you become one of a family of builders. Rutan Aircraft prides itself on its builder support program. We will answer questions either by phone or in writing. Builders are also welcome to bring parts to Mojave for inspections and advice. The quarterly newsletter is mandatory when you are building, as it provides continuing builder hints, ideas and plan updates.

ALL RAW MATERIALS.

Near Los Angeles.
AIRCRAFT SPRUCE
201 W. Truslow, Box 424,
Fullerton, CA 92632
(619) 870-7551
Catalog $4

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WICKS AIRCRAFT
410 Pine Street,
Highland, IL 62249
(618) 654-7447
Catalog $3

ALL PREFAB MACHINE PARTS.

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(714) 898-4366
Catalog $3

PREFAB FUSELAGE, CANOPY, TURTLE DECK, WING SPARS, SEAT PAN.
TASK RESEARCH
848 East Santa Maria, Santa Paula, CA 93060
(805) 525-4545

SPECIFICATIONS
SOLITAIRE - RAF Model 77-6

Empty Weight ..... 380 lbs.
Gross Weight ..... 620 lbs.
Total Wing Area ..... 102.44 square ft.
Span ..... 41.75 ft.
Wing Loading ..... 6.05 lbs./square ft
Engine ..... KFM 107E
BHP ..... 23 at 6000 RPM

Fuel ..... 5 gal. premixed @ 40:1
L/D ..... 32/1 at 50 knots
Min. Sink ..... 150 ft./mn @ 40 knots (approx.)
Descent Control ..... Spoilflaps usable to Vne
Min. Flying Speed ..... 32 knots
Vne ..... 115 knots
CG ..... unaffected by pilot weight

SOLITAIRE DOCUMENTATION
Canard Pusher Newsletter published quarterly.
One year's subscription $6.75

Section I - Manufacturing Manual $225.00
This is the complete education and construction manual for building the entire SOLITAIRE except for the engine installation. This manual consists of a spiral book 11" x 17" together with a set of 23" x 33" drawings, which include all necessary full-size templates, jigs and cross sections.

Solitaire Owner's Manual $8.00
This is the required operations handbook and checklist for flying the SOLITAIRE.

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Our intrepid leader, Burt with his latest flying model, "Rusty" a Blue and Gold McCaw. Burt is studying Avian Aerodynamics! **PHOTO OMITTED**

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THE CANARD PUSHER NO 44 APR 85

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 44. If you are building from 2nd Edition plans you must have newsletters 18 through 44. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 44. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 44. If you are building a Long-EZ you must have newsletters from 24 through 44. If you are building a Solitaire, you must have newsletters from 37 through 44.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

The RAF hangar is located on the west end of the flight line at the Mojave Airport, Mojave, Ca. approximately 80 miles north of Los Angeles. You are welcome to come by and see our aircraft or to bring in any parts for our comments. We are normally open from 8:00 to 12:00 and 1:00 to 5:00 on Monday through Friday and 9:00 to 3:00 on Saturday. Closed Sunday.

If you are planning a trip to see us, please call first to assure that someone will be here to assist you, since occasionally we are gone to flyins. When arriving at Mojave by car turn east at the Carl's Jr. restaurant to find the airport.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
Much work has been done on building and testing the new Roncz canard for the Long-EZ and getting the plans ready to go to the printer. We are pleased to tell you that they are at the printer and should be available in four weeks.

Mike and Sally flew the Defiant to Sun n' Fun in Florida. A complete annual inspection was required before leaving on this over 5000 mile round trip.

We have checked out a couple of pilots in the Solitaire, and we have had old Grizzly out several times in the last few weeks.

RAF FLYIN - MOJAVE 1985
RAF will be hosting an EZ flyin here at RAF, Mojave California on June 8, 1985. A special day, all RAF airplane builders, flyers or interested persons are welcome. Drive in or fly in and enjoy the company of others with a common interest. For those who will be flying in, we are having a spot landing contest between 9 am and 11 am. There will be a white chalk line across the active runway with judges with a portable radio. If you wish to try your luck for an accuracy landing, give a call on downwind (on Unicom 122.8) stating that you are in the contest. Give your type, color and N number. Your arrival landing will be your only attempt, make it good!!

Taxi to RAF, which is near the west end of the ramp. Bring tie down ropes, there are lots of hard points in the cement ramp.

We will have a hands on demo after lunch of some of the new techniques used to build the new R1145MS canard, a new material for finishing and of course all the RAF staff will be here to have fun and answer any questions.

In the past, we have had a couple of these flyins for Burt's birthday. This flyin is a combination of Burt's day and a get together of EZ builder/flyers, a fun flyin, some pattern flying, buddy rides, hanger flying and whatever else makes you happy!! We will have hot dogs, soft drinks and sandwiches available at the hanger, or bring a picnic lunch. There is plenty of parking for cars and planes.

Come and join in the fun on June 8, 1985. There is no group in the world like the EZ builder/flyers, you are all great!!

SUN 'N FUN
Sally and Mike departed Mojave at 6:15 am on Sunday morning, 17 March. Light to moderate headwinds were experienced all the way to Elk City, Oklahoma where we stopped for lunch and to have a new vacuum pump installed. This first leg was 940 nm (1081sm) and it took 5.4 hours, an average ground speed of 174 knots (200 mph). 74 gallons of gas was used for an average of 13.7 gph. From Elk City we flew to Muscle Shoals, Alabama, 590 nm (679sm) in 3.4 hours for an average ground speed of 173 knots. This leg used 46 gallons for an average burn of 13.5 gph.

At Muscle Shoals we spent the night at the home of Frank Yost, a Defiant builder who has also completed and flies a Long-EZ. We drove to the location where he is building his Defiant and were very impressed with his progress. His Defiant is on the gear, the canopy and turtledeck are mounted. The fuel strakes are complete, the wings are mounted with both engines mounted. Still to do are winglets and canard. A couple of Long-EZ builders have been helping with the project and it certainly looked like Frank will make it to Oshkosh 1985. The next morning we took off and climbed to 13,500 where we found a 51 knot tailwind! The first tailwind since leaving California. We flew to Lakeland in 2.5 hours, a distance of 520 nm, averaging 208 knots ground speed. We arrived in the middle of the afternoon airshow, due to the time change and no notam at flight service (!), so we drove

over to visit Johnny Murphy in Merrit Island. He was not home, so we headed back to Lakeland, landing at Bartow, to wait and lay on the ramp eating chips!! After the airshow we flew into Lakeland and parked amidst about 30 VariEzes and Long-EZs. We stayed all week and talked with lots of EZ and Defiant builders. This was the first major flyin that there were more Long-EZs than VariEzes. It was difficult to get an accurate count, due to many of the EZs coming and going (the Bahamas, Key West etc!) during the week, but we estimated at least 40 EZs flew in during the week.

One of the highlights was the Sun 50 Race, originally started by Dick Rutan as an EZ race. This year it was run by Charlie Gray and was open to all comers. Six Glasairs, six Long-EZs, two VariEzes, one Brokaw Bullet and one Dragonfly started the race. The start was right off the main runway at Lakeland and Charlie and his assistants flagged each airplane off at 20 second intervals. As soon as the last one broke ground, Charlie jumped into the Defiant and we headed for the finish line at Winterhaven airport. We got there in plenty of time and the first airplane across the line was a Glasair, 180 hp with constant speed and retractable gear. Surprisingly the next airplane was Herb Sanders in his Long-EZ. Dr. Brokaw in his Bullet got lost so he came in 15th. This race was held over a 60 nm course. The winning time was over 210 mph the slowest time was 113 mph, the Dragonfly. Not bad, from a standing start with a VW engine. A good time was had by all, no one had any serious problems and it was exciting to be at the finish line.

During the week we met lots of old friends and made new ones. We managed to visit Johnny Murphy's Defiant project and he really is going at it. His Defiant was upside down and he was finishing the bottom. His wings were ready for primer as were his winglets and canard. Both engines have been mounted and most of the plumbing and wiring was complete. Workmanship is excellent, and we are really looking forward to seeing this one at Oshkosh '85. Look for a few surprises, Johnny hardly

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ever builds exactly to the plans and this one is no exception!!!

We also were able to make it over to Orlando, where Charlie Gray is building two Defiants! Charlie and his son Marshall are doing excellent work and are going great guns. Both fuselages are on the gear. All four wings, winglets and two canards are done, and centersection spars are mounted. It won't be too long and one or both of these will be flying.

The EZ Dinner was really super. About 120 people enjoyed excellent food, listened to much hanger flying and Charlie handed out over $600.00 worth of door prizes. Race results were announced and all participants will be getting a copy of the results.

Place	Aircraft	Pilot	Speed	Time
1	Glasair-180-RG	Bob Gauinsky	210.15	19:42
2	Long-EZ-160	Herb Sanders	192.11	21:33

3	Glasair-160-RG	Don Conover	189.30	21:52
4	Glasair-160-RG	John Murphy	188.30	21:58
5	Glasair-160-TD	Robin Young	188.18	22:00
6	Long-EZ-160	Marty Ellison	187.49	22:05
7	Glasair-160-TD	James Cline	186.32	22:13
8	Glasair-160-RG	Ray Ward	184.16	22:29
9	Long-EZ-125	S. McCaskie	176.17	23:30
10	VariEze-100	Tim Gehres	172.83	25:16
11	Long-EZ-115	Jim Rutland	172.14	24:03
12	VariEze-100	Jack Fehling	168.84	24:31
13	Long-EZ-115	Beau Wold	162.86	25:25
14	Long-EZ-115	Robert Prior	153.05	27:03
15	Bullet	Bubby Brokaw	144.35	28:41
16	Dragonfly	Gary Konrad	113.42	36:30

We left on Saturday and flew all day long into strong headwinds. We spent the night at Fort Stockton, Texas (an excellent overnight/stop over incidentally) and made it back to Mojave around noon on Sunday. We covered 2050 nm (2359 sm) in 11.3 hours at 181 knots average ground speed, and averaged 13.6 gph going to Lakeland, coming back we flew 2010 nm (2313 sm) in 13.4 hours, for 150 knot average at 15.0 gph due to headwinds and low altitude flying. The Defiant performed great, what a fabulous cross country airplane! Thank you Burt, for letting us use your baby!

LONG-EZ CANARD UPDATE
Since the last newsletter, we have built yet another canard! This one was built to proof the plans and to test the final hinge pivot location called out by John Roncz. This canard was mounted on N26MS and flight tested throughout the Long-EZ envelope, including flight in varying degrees of rain at speeds from 60 knots to 150 knots in 10 knot increments. The trim change at any speed is negligible, although the "stall" speed, or more correctly the minimum speed or full aft stick speed is higher in rain than in dry air by anywhere from 2 to 10 knots, depending on rain intensity.

This new canard is the final plans built configuration and uses a completely new method of hinging the elevators to the canard. All new hinges and Brock parts will be required. Ken Brock will have these parts available by June 8, 1985 (the RAF EZ Flyin, Mojave). There are a few parts that can be used from the original plans built GU canard, but most of the metal parts are new and different. There are only two hinges on each side of the canard that are visible outside the fuselage and these hinges are essentially flush with the bottom of the canard.

The new canard's primary design goal was to have no trim change when flying into or out of rain. We are satisfied that we have accomplished that. The trim change is essentially non existent at least on the two Long-EZs we have tested here at RAF. In addition we have measured a small increase in top speed and a small decrease in minimum speed, on the order of 1 1/2 to 2 knots depending on the individual airplane.

With the installation of this new canard airfoil, we have found that vortilons are mandatory on the leading edges of the main wings. With higher lift performance on the canard, we are driving the main wing to and even beyond it's critical angle safely. All of this information is covered very thoroughly in the plans, and there are also lots of photos

of the canard under construction. The plans should be back to us by the first week in June and we are currently planning on introducing them at the RAF EZ Flyin on June 8th. Price will be $42.50 per set. Ken Brock has promised to have several sets of prefab metal parts available here at the RAF EZ Flyin. We do not have prices on the metal parts as yet.

We are very pleased with this new airfoil, and it accomplishes our goal but we do not consider it to be a mandatory change or addition to a Long-EZ. If you are happy with your present canard or if you have built and installed the original canard on your as yet untested Long-EZ, you do not have to build the new canard. It is an option, and can be retrofitted at any time. If you are uncomfortable with your present rain trim change, or if you like the idea of the latest airfoil with flush hinges and curled up wing tips, by all means build one and install it. If you do, please let us know how it performs on your Long-EZ compared to the original.

Once again, this new R1145MS airfoil is too powerful for the VariEze and is not recommended.

Mike and Sally's Long - N26MS - is in the shop for a few changes and a face lift. This airplane has 925 hours and is over 4 years old. We are installing new upholstery, and will be repainting the whole airplane. While it is down, we are doing a few things to it that we have always wanted to do, but have never got around to. We are installing a Loran-C, we chose a Micro Logic 6500. We are also installing a F-TEC ST-1A engine monitor meter. This promises to be a really neat multiple engine functions gauge as well as a great panel space saver.

In addition, we have modified the trailing edge of the cowling, by extending it aft about 3" towards the prop. The goal here is (hopefully) a lower drag cowl with improved cooling. We have also moved our brake master cylinders up into the nose. This modification has been done by many builders, using several different methods. The advantages are better access to firewall area, mags etc, and for cg, weight on the aft end moved into the nose is better.

All of the above are now in the works. This is quite a major undertaking, requiring a new instrument panel. Oh yes, we are completely rewiring the entire airplane! Please don't call on any of these mods. We will thoroughly flight test all mods and report on the results in the next newsletter. We anticipate flying in about 6 weeks time.

VARIEZE/LONG-EZ ROLLOVER/HEADREST

We have received a letter from Andrew Detroi of the FAA concerning the forced landing/crash of a Long-EZ that he investigated. This crash involved a Long-EZ that lost power after takeoff. The pilot made a successful 180 degree turn, landed long and left the runway. The nose gear collapsed, the nose dug in and the aircraft flipped inverted with enough forward velocity to break the canard in half and rip one wing off at the end of the centersection spar. The rollover/headrest was broken off. The pilot and passenger received minor head cuts, scratches and bruises.

This letter has been distributed to the various FAA offices and in some cases redistributed with some inaccuracies. This has caused some consternation among the local FAA and among groups and individual Long-EZ builders.

We have spoken to the FAA in Chicago and they have agreed with us that obviously the pilot's head rest is not, nor was it ever intended to be strong enough to resist the forces imposed in an inverted crash with any appreciable forward speed. It is a roll over structure, and has proven that it will remain intact in the event that one of these aircraft should roll over with little or no forward speed. This was in fact the case, when Ken Swain flipped his EZ in a corn field near Oshkosh after an engine failure. His aircraft ended up resting on the rollover structure (canopy broken), the firewall and two broken winglets. He was not injured, but had to wait for others to lift the aircraft to get out. The rollover has provided this protection in at least two other cases, one example is in CP #14.

However, the rollover structure is obviously not designed to handle an inverted landing! This structure is also a head rest and doubles as a map case/storage area. It will not protect you should you strike the ground inverted or roll over with any significant speed or impact energy.

We of course object to Mr. Detroi's inference that the rollover should have (or could have) provided protection in an earlier Minnesota Long-EZ accident that was not survivable, regardless of the head rest. (See CP #31).

Design loads for an "adequate" roll over protection are difficult to define. Obviously, a second landing gear on the top could protect for 10 ft/sec drop at full landing speed and just as obvious a very heavy structure would be snapped off by a hole or curb at only 10 mph. RAF does not have a specific recommendation in this area and we will not be reinforcing our headrests. The decision to do this rests with each individual homebuilt manufacturer. RAF will continue to strive to openly pass along all information to help you in your building decisions. You may for example want to change references of "rollover structure" to "headrest" if you feel this is more appropriate.

DEFIANT NEWS

Burt's Defiant, N78RA how has well over 900 hours of flight time, much of it being test flying but most has been actual utility exposure in cross country trips from Alaska to the Bahamas. She has seen some hard tests of character, such as a 1260-lb cabin load to challenge her class in CAFE '82, altitudes over 28,000 feet, a flight of over 15 hours, considerable IFR operations including icing, heavy rain and the "Mojave rotor" turbulence.

This experience is unsurpassed in the homebuilt area as far as being able to support the new builders with actual flight data. However, it has all been attained with our "basic vanilla" configuration with fixed-pitch wood props. Now, however, many of the initial builders have decided to equip their aircraft with constant speed props, thus

getting into an area untested by us. The Defiant Owners Manual, Edition One, covers the fixed pitch prop configuration. In order to support those desiring information on the acceptability of a constant speed prop installation, we have begun an update modification of N78RA.

We will be installing a 180 hp (O-360-A1A) Lycoming on each end with constant speed props. We are also redoing the instrument panel and the interior, so for Oshkosh 1985, look for a really super Defiant. Test data on the constant speed prop flights will be available this summer and will be passed along via the CP newsletter.

We hear from quite a number of Defiant builders and it is astonishing now rapidly these airplanes are going together. Rodie Rodewald in Hawaii, is moving on his, almost all structure is done, and he is installing zero time O-360 (180 hp) with Hoffmann constant speed props. He won't make Oshkosh this year but does intend to use his Defiant to "commute" back and forth between Hawaii and the mainland!

Don Foreman in England, a VariEze as well as a Long-EZ builder is also going great guns. His fuselage is done, and is on the gear with centersection installed. His will almost certainly be the first European Defiant.

What we need is photos of Defiant projects to display in the CP. Johnny Murphy, Frank Yost and Charlie Gray have sent us a few otherwise we have not had much feed back. Send photos - PLEASE.

Defiant Prototype Engines, Props and Equipment for Sale
Included here is an engine that dates to Burt's original work in Aviation. The front Defiant engine had 1375 hours when Burt bought it in 1968 for the VariViggen. It spent 600+ hours pushing the original Viggen (airframe is now in the EAA museum) then after an overhaul 900+ hours pulling the Defiant. Both engines are running fine, but, for liability reasons, RAF will insist that the buyer agree to overhaul before use.

Items and Descriptions
1. 160 hp O-320-AZA converted to high compression pistons and 1/2" valves (not approved for certified aircraft). Total time 3441 hours, 905 STOH. (Defiant front engine) complete with generator, 2 mags, carb, heat muff, starter (21v).

2. 160 hp O-320-EZD converted similar to Item I. Total time 2830 hours, 980 STOH. (Defiant rear engine) complete with alternator, 2 mags, carb, new vacuum pump, starter (12v).

3. Two exhaust systems for Items 1 and 2, shortened to fit Defiant.

4. Two wood props for 160 BHP Defiant.

5. Two 8" prop extensions.

6. Two Brock spinners with added front plates.

RAF will accept sealed bids on individual items, or the lot, until June 8 - Pickup if you can at our June 8 Flyin.

WARNING
We have recently learned that some Long-EZ operators have been attempting to overextend the intended capability of the aircraft by installing larger engines than the O-235 and/or by attempting overweight operation. These practices are hazardous and cannot safety be conducted on the aircraft. A re-design to allow this operation would not be just a simple replacement or beefup of a few components.

A major development for adequate airframe/propulsion mounting/landing gear/brakes would be required, as well as wing area increase to meet reasonable energy limits for forced landing. In short, you would be talking about a new aircraft and a new test program.

Overweight operation will definitely result in structural problems with landing gear, brakes and possibly airframe.

LIGHTNING STRIKES ON FIBERGLASS AIRCRAFT
We recently received information from NASA and from Andy Plummer of Lightning Technologies Inc, a recognized expert in this field, regarding lightning strikes on fiberglass aircraft. At this point in time there is not one single documented case of a fiberglass sailplane being struck by lightning. This is surprising, especially in Europe, where sailplanes do fly in the clouds. There is no documented evidence of any EZ or composite type having been struck and damaged. There is however, one documented case of an all wood sailplane which was struck, with catastrophic results. There are many cases of radones, glass tail fins, etc. on airlines being struck with damage from insignificant to quite considerable.

The expert opinion from both NASA and Mr. Plummer, is that it could happen and if it did, it may be possible to suffer catastrophic damage. Mr. Plummer states, "I am firmly convinced that fiberglass aircraft are just as likely to receive a lightning strike as a metal aircraft of the same size". The consensus of opinion is to stay well away from thunderstorms or cloud formations that may generate lightning.

VORTILONS
We noticed that almost all of the VariEzes at Sun 'n' Fun had vortilons installed on their wing leading edges, some even installed them over the cuffs! During some of the bull sessions, we talked to the builder/pilots and all agreed that the vortilons are well worth having. Slow speed stability, visibility over the nose for take off and landing were greatly improved. If you have not already installed them on your VariEze, do it, you will like 'em. We believe it is better to remove any existing wing cuffs before you install the vortilons,

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and the vortilons are definitely superior to the cuffs and are lower drag. We are even starting to notice a few Long-EZs with vortilons. Yes, they will improve visibility over the nose and lateral stability a little (with the standard canard) but we did not feel they were warranted until we flew the new R1145MS canard. As we mentioned, if you install the new canard on a Long-EZ, the vortilons are mandatory. They are not an option. The new canard with no vortilons can drive the

main wing to such a high angle of attack that the main wing can stall before the canard does.

Vortilons are impressive little devices, but keep in mind that they only work on a swept wing. It would not help to put them on your canard for example. Any straight wing with no sweep will not benefit from vortilons.

PREFABRICATED GLASS PARTS
Task Research Inc. is no longer an approved RAF manufacturer/distributor. Due to a contractual disagreement, RAF has exercised our option and cancelled all of our contracts with Task Research. We have placed all of our tooling with a new company.

Aircraft Spruce and Wicks Aircraft still have many items such as cowlings, wheel pants, nose gear boxes, strut covers and sump blisters in stock. If you need any of these parts, contact Spruce or Wicks. If you are unable to get the parts you need, contact RAF and we will place your name and requirement on a priority list. The Long-EZ and Defiant main gear struts are not available at this time and it will be June 1, 1985 before our new supplier will be on line and producing gear. If you are to the point where you will be needing a main gear (or Long-EZ nose gear) strut, call us at RAF and we will place you on the priority list. Do let us know your requirements, it will help a great deal to know what the demand is. Our new supplier is an EZ builder himself and a very experienced man, who has worked with composites for years. We are confident that he can do the job, and we feel certain that anyone receiving one of his parts, be it cowlings or landing gear struts, will be pleased with the workmanship.

A major change over such as this, is always upsetting and can cause delays. Please bear with us on this one. Give us a month or two to get our new supplier up to speed. We would really appreciate it if you could try to work around, for example, the main gear. You can in fact go on and build winglets, main wings and centersections. You do not absolutely have to have a main gear until you have essentially completed construction.

RAF will work with you as a go between and will do our best to accommodate those of you who simply have to have a particular part. For the time being we ask your patience. Just as soon as the new supplier is up to speed, we will announce his name, phone number etc. and you will work directly with him.

FOR SALE
Lycoming 0-235-L2C, 1240 hours total, disassembled - $2650.00 as is. Includes logs, rebuilt mags, carb and rebuild kit.
Contact: Joe Heapy
(213)947-3889 - work
(213)895-7943 - home

Continental 0-200, 160 hours since major. Removed from a VariEze, ready to go. Includes stainless exhaust system, 10 amp alternator, prop extension, oil separator, mount, baffles and carb heat. We are building a Defiant and donating the EZ airframe.
Contact: John Steichen
960 86th Street

Downers Grove, IL 60515

Lycoming 0-320-E2D, many other parts.
Contact: Ed Rolita
(813)639-7157

Solitaire Engine KFM 107E, new in the factory carton, never used. $1,000.00
Contact: James Baldwin
1465 Valparaiso Avenue
Menlo Park, CA 94025
(415)835-1444

Defiant Builders - Apache, good condition, can be flown home and used for parts, engines mounts, props etc.
Contact: Rex
(602)466-9244

Flight Research mufflers for Continental 0-200. Never used. Stainless steel with heat muff. Cost $325.00, will sell for $150.00 or best offer.
Contact: Phil
(818)352-0326

Electric heater for VariEze or Long-EZ $90.00.
Contact: Dave Petrosino
(907)235-7517

Great American prop, 56 x 68 for 0-200 VariEze - $165.00.
Contact: Dave Dingerson
(303)696-1006

SHOPPING
Aircraft Spruce is pleased to announce that they are now open on Saturday mornings from 9 am to 12 pm. This is a convenience for builders who are visiting Los Angeles or for those who live there. Due to personal limitations, they do ask that you call in your order during the week for pickup at the "will call" desk on Saturday.

Great American Props has made a video tape which covers how to install a wood prop and many other related items. A $25.00 deposit is all that is required to be able to see this informative tape. You pay the postage and your deposit will be refunded when you return the tape.
Contact: Great American Props
1180 Pike Lane #5
Oceano, CA 93445
(805)481-9054

Ken Brock Manufacturing reports that they are now on line with Defiant prefab metal parts. Ken also has the "S" glass roving wetting wheels (see Page D-58) available. These are well made and run dead true and include the knife edge wipes. Ken is currently working on the prefab metal parts required for the new R1145MS canard. He will have these available around June 1, 1985.

VOR/LOC/GS ANTENNA

We recently tested one of these simple, light weight antennas (part #AD-1) on the Long-EZ and found it to be excellent. The distance from the VOR for usable navigation is increased and our left/right needle does not fluctuate as it used to. This antenna is installed exactly like the plans. It is essentially a copper foil antenna with a small "black box" with BNC connector in the center. Inside the "black box" are state of the art, micro electronics that allows better reception characteristics over the standard kit antenna.

Contact: Antennas Dynamics Inc.
1251 W. Sepulveda Blvd., Suite 268
Torrance, CA 90502
(213)534-1090, Ext. - 22

Jackpot Flyin And EZ Races
This was the best flyin of 1984. Mark it on your calendar now. July 5, 6 and 7th, 1985 at Jackpot, Nevada. Cactus Pete's Resort Casino is the place to stay or camping is available. EZ races with prize money will be held on the 6th of July. A ribbon cutting contest, spot landing contest on the 5th of July, a dinner show at Cactus Pete's, and an Awards Banquet on the 6th of July.

Contact Shirl Dickey for details. Do it now, because there will be a lot of EZs flying in to this one. Shirl and Diane Dickey are the organizers and last year their flyin was the best and most fun flyin we attended.

Shirl Dickey
1646 Allegheny Drive
Murray, UT 84123
(801)974-7527 - work
(801)268-3360 - home

Solitaire Enthusiasts - a motor glider mountain soaring rendezvous will be held in Sun Valley, Idaho on August 3-18, 1985. The Friedman Memorial Airport at Hailey, Idaho is the site. Call Bob Moore (509)967-3733 if you plan to be there.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category Definition

MAN-GRD Mandatory, ground the aircraft. Do not fly until the change has been accomplished.

MAN-XXHR Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.

DES Desired - strongly recommended but not requiring grounding of the aircraft.

OPT Optional - does not effect flight safety.

OBS Obsoleted by a later change.

MEO Minor error or omission.

No VariEze Plans Changes

No Long-EZ Plans Changes

DEFIANT PLANS CHANGES

DPC #24
Bill of materials and Section I, Page D-37. 16 bolts AN6-16A are not correct (used to attach main gear). 16 bolts AN6-11A are what is required.

DPC #2
Section I, Page D-26 and D-48. Aileron to control stick hookup. The 3/32" dia control cables that run down each side of the fuselage from the C-17 fittings at the left and right control sticks to the C-27 weldment aft of the rear firewall, should not cross each other on the left side, but should cross each other on the right side. This is important in order to get the aileron "sense" to be correct with both control sticks.

SOLITAIRE PLANS CHANGES

SPC #52
Section I, Page 18-2 and 18-3. The bottom righthand paragraph on Page 18-2 calls out the distance 3.5" aft of center to align the SCL-2. This should be .35" as shown on view C-C on Page 18-3. When aligning the canopy latch start by positioning the SCL-3 over the plywood insert in the canopy frame and position the SCL-2 as required based on the fuselage station of the plywood insert. This may move the latch assembly slightly forward or aft of F.S. 88.5. On Figure 18-9 the plywood insert is shown as extended to the canopy frame it is in fact flush mounted into the frame. This has the effect of moving the SCL-4 handle outboard slightly.

SPC #53
Engine Section, Page 21 - Parts list. Under miscellaneous. 1 each flow control valve #3944. We have found a smaller slightly less expensive flow control valve. This is a Parker Fluid Power Manatrol Division, Elyria, Ohio, 44035. This can be purchased through Northern Hydraulics Inc., 800-533-5545, 801 East Cliff Road, Burnsville, Mn 55337, Item #2055. Also remove the two AN912-3 reducers and add two

AN912-1 reducers. This is installed in the same position as the original.

SPC #54
Section I, Page 12-1, Step II - Wing Attach. The upper skin on the spoil flap attach area must be removed for 2 1/2" to allow the SWA-14 to be bolted onto the lift tab. Then install a foam block with wet micro and replace the two plies of BID at 45 degrees lapping onto the SWA-14 after careful sanding. **SKETCH OMITTED**

SOLITAIRE NEWS
SSA Convention - The SSA held it's annual convention in San Diego last month. This convention serves as an annual membership meeting and a chance for the various suppliers to the industry to show off their wares. Bob Matheny brought his nearly complete Solitaire to the convention hall to display. This is a tremendous effort and shows a great deal of concern for the sport of Soaring and the SSA membership.

Our hats are off to Bob and our thanks. Bob's Solitaire displayed the kind of craftsmanship he can be proud of. Bob by the way looks like he may be the first homebuilt Solitaire to fly.

Don Wemple and Bob Matheny also organized a Solitaire discussion group during the convention to discuss Solitaire news building progress and an alternate engine retraction system being developed by one of the Solitaire builders, Herb Abrams. This was a very informative meeting and although the number of Solitaire builders is not large the enthusiasm they have shown certainly is. On the final day of the convention the Soaring Society had lined up with the Torrey Pines Glider club to check out pilots with winch ratings on the winch launch at Torrey Pines. Torrey Pines glider port is located on top of the cliffs overlooking the Pacific ocean and is a truly unique location for slope soaring. While the gliders were being launched a motor glider came soaring by, no wait in line, no worry about the complexities of winch launch. It was hard not seeing a Solitaire take off under its own power and work that lift. The San Diego builders should have a great time when their projects become airborne.

Herb Abrams, a Solitaire builder from Ohio was recently out to California to attend the SSA convention and before returning home stopped by Mojave and went for a check out in the prototype Solitaire. His report on how the flight went and what its like to fly the Solitaire follows.

"SOLITAIRE FLIGHT REPORT FROM A BUILDERS VIEWPOINT
I will admit what macho airmen will not, that is, building my own Solitaire is sort of like building a dream. The dream is of a sleek, professional looking sailplane which will provide:

1. Convenience and ease of handling.
2. Self launching and reasonable cruising ability for independence of operation and cross country return.
3. Safety of operation, spin resistant.
4. Reasonable performance.
5. Reasonable cost.
6. Latest material and construction technology.

Now Solitaire builders, I have flown the Solitaire. It

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is more than I expected. It was great. The only question I had in my mind was would the ride in rough air be sea-sickness inducing. The answer to that one and others regarding forward visibility, pitch sensitivity, and ease of spiralling is a resounding "not evident".

Solitaire is easy to fly, self launching, is immensely less stressful and more satisfying than airplane tow, glide path, and speed control and landing is easy and precise with the spoilflaps, taxiing and ground handling is a breeze and the engine operation is flawless. I was even able to extend and start the engine during the landing rollout! Yes, the prototype Solitaire I flew had rather marginal rate of climb but the new KFM engines produce more power, the just issued engine installation plans provide a few more inches of propeller and a longer prop engine installation I am developing, all promise to improve the climb rate. In addition, I am sure our Solitaire builders' airplanes with the improvements already incorporated in the plans, and perhaps some of their own, will perform even better than the prototype. In a word Solitaire does all it is intended to do and in an easy way to make soaring safer and more convenient for us sport soaring enthusiasts.

Mike Dilley provided briefing on switch operations, those for the engine operation and fuel level and showed me how to position the propeller for retract. All uncomplicated. Mike described runway locations and suggested practice areas. My biggest problem was shivering from cold and probably anticipation. Taxiing is normal and easy if one lets the wing stay on the ground while traveling downwind. Into the wind holding the wing level with aileron was no problem. I got carried away with trying to turn into the low wing like riding a bicycle to make it come up. This only caused much flopping around and diverted my attention from obstructions like landing lights.

The takeoff was uneventful. I pointed the nose down the runway and opened the throttle. Remember this is at my choice, not the tow-pilot's. There was no problem with engine or canard obstructing vision. The airplane gained speed in reasonable time and eased off with slight back pressure. The climb to 250 feet engine out rope break turn back altitude is less stressful than an airplane tow! This is what I was looking for. Rate of climb was low and therefore back pressure on the stick had to be carefully modulated to obtain the best rate of climb, sink occurs if too slow. This is normal pilotage. Pitch control is light and quick but not out of the ordinary and presented no problems.

The airplane flies like you would expect a self-powered sailplane to fly. The engine makes noise but 60-70 knot cruise was easily attained. Turns, both shallow and steep, with power on, are exactly like any sailplane except less adverse yaw was evident. The canard makes a good angle of bank with the horizon reference. The controls are all light and well coordinated. Rough air surprise. The airplane bumps but does not produce any disagreeable air-sickness inducing motions that I had feared because of the flexible wing. The airplane rode like a short wheelbase car, sort of short-coupled. Pitch was no problem. It was

not any more sensitive than the Pegusus I have been flying. In a word, I was delighted.

I climbed to the cloud base using every ump and with careful trying of recommended climb speeds. The airplane type rate-of-climb, not compensated or sensitive, combined with equal number of very strong down drafts, made any climb rate observations meaningless. But climb performance was not a factor to me because I had spent the past four months engineering a long prop (46 inch) engine installation to provide the thrust required for a comfortable climb rate.

Sailplane flight was very enjoyable, but shutting down the engine and stowing it the first time really is interesting and exciting. The engine stopped smoothly with the prop close to vertical. I started retracting the engine and saw the prop touch the side, so reversed the switch, the engine came back up, a touch on the starter switch centered the prop, and then the engine retracted. The motion is one that is almost anti-climatic. The silence was deafening. But then what. I was just flying in a beautiful sailplane. Well, just as I dreamed, here was soaring flight - - just as planned and that is what the Solitaire is all about. Turns, slow flight, stalls, all easy, gently and pleasant. Steep turns required some aileron to hold it from rolling in, but very little rudder was required. It tried cruising at speeds up to 100 knots. Solitaire flys like a 32.1 sailplane as advertised.

Power off flight started about 2500 feet agl so with zero sink for awhile, approximately 15 minutes before I had to enter the pattern, I was able to try stalls and turns as much as I desired. The winds were 20 knots gusting to 30. Recommended air speed was about 60-65 knots. When I am in a new sailplane and uptight, I tend to fly faster, so approach was about 70 knots with no trouble maintaining constant speed. I opened the spoilflaps about halfway opposite the numbers after having opened them full while at higher altitude and flew a normal base leg a final. The spoilflaps are a real joy. The nose pitches down slightly and the lift/slowing sensation can really be felt. As instructed, I maintained the glide path nose down attitude to flair altitude then slight back pressure to level out and sink onto the runway. Opening the spoilflaps full at the same time and glueing it on. Easier than landing an ASW 19 or a Pegusus. Then to show how much I was in control during the rollout, I extended the engine, started it and continued the roll. Fantastic. This is what the dream and the promise is. What more can I ask for. I flew through another but shorter flight, but because the fuel level started to blink, I had to cut it short. All of my impressions were reinforced however.

I was asked if I was happy I bought the kit and my answer was most certainly. I know the prototype aircraft I flew will not be as good as mine! My doors will close with engine up and will fit better with the engine stowed. How could I not be excited as I had flown the airplane and it had done all it was planned to do and with none of the problems I had worried about, such as funny rough air ride, difficult pitch control etc. All of the negative observations I had heard had not manifested themselves.

I am more excited and anxious to finish my Solitaire and start enjoying it. After all, this sailplane is the first of the line and improvements are sure to emerge.

I cannot thank the Rutan and Solitaire staff and engineers enough for the opportunity to fly the Solitaire. They have been most cooperative, patient and helpful to me. Mike Melvill and Mike Dilley are terrific people. We Solitaire builders and other Rutan builders as well, owe them a debt of gratitude. Designing, testing and producing plans for innovative aircraft take a lot of talent and resources. They deserve all the support we in the soaring sport can give them.

Herb Abrams"

Engine Plans
Solitaire engine plans have been shipped to all builders that have ordered them. Anyone wishing engine plans may order them from RAF at a cost of $25.00 These plans cover the engine installation of a KFM direct drive engine in the Solitaire. These plans cover all aspects of the engine installation except the exhaust system. The prototype has an exhaust system that was manufactured by a company that is now out of business. We are looking for a new company to build these and hope to have a place to buy them that we can announce in the next newsletter.

SOLITAIRE BUILDER HINT
Some of the lift tab pockets and tabs do not fit together as they should. If you have bought yours from Ken Brock Mfg. fit your lift tabs into the pockets SWA-13 assembly and install the SWA-17 lift tab pins. These should allow a slight amount of vertical movement in the lift tabs but no play in the holes that the lift tab pins go through. If your lift tabs SWA-10 and SWA-15 do not fit into the SWA-13 you can file the end to remove any interference. Be sure to remove any sanding scratches and if the lift tab holes do not line up well or fit well you can open them up to 5/16 by drilling and reaming with the lift tabs in the pocket. Ken Brock is in the process of correcting the problem on these lift tabs.

BUILDER HINTS

DEFIANT - Installing the canard into the fuselage is one of the few really critical areas in that very careful dimensional control is required. The dimension between your bulkhead F.S. 57 and the forward firewall at F.S. 47 a theoretical dimension of 10 inches, can easily shrink due to builder tolerance, glass plies building up on the firewall etc. Pay very close attention when you build your lift tabs or attach tabs on your canard. The dimension you end up with between your F.S.57 and F.S.47 bulkheads is the reference dimension you need to use when building the attach tabs on your canard. Very important: Do not forget to factor in the thickness of TWO .063" thick CS-8 plates, TWO CS-11 flanged bushings (.032" thick flanges) and one CS-9 plate (.032 thick). If you neglect to do this you will have a difficult repair problem. The canard, with attach tabs plus ALL hardware (CS-8, CS-9 and CS-11) should be an easy slip fit between F.S. 57 and F.S. 47. Before you build the attach tabs, study the drawing on Page D-26

and read these words until you are really sure you know what you are about to try to do. A mistake here will cost you a lot of time. If you think it through and do it right, it will be easy.

A possible suggestion would be to install Bulkhead F.S. 57 with its forward face at F.S. 57.1. This additional 0.1" of space should make it easier to fit the canard lift tabs plus metal hardware. If your canard then is slightly too small, you would have to build up the face of bulkhead F.S. 57.1 with a few plies of BID glass as required to obtain a nice fit with no play or excess space.

DEFIANT - When you make your DWA-4 and DWA-8 plywood hard points for the wings, you should first make a cardboard template of your own centersection spar jig in the corresponding area. This cardboard jig will then tell you just exactly how much you need to bend the plywood laminate. Fred used 0.5" and it worked great for him. Due to builder tolerances it is possible that you may require 0.6" or even 0.7" on your parts.

DEFIANT - The front firewall will have to be notched at the bottom in the center in order to allow the nose gear to turn left and right for nose wheel steering. This cut out is not shown on the full size bulkhead drawing on Page ???. We suggest that you install the nose gear, and then notch out the firewall as required to allow full steering movement. Do not cut out any more than what is required, since this is a potential leak in the pressure cowling. A piece of neoprene engine baffling material riveted to the firewall above the gear cut out, so it hangs down over the cut out area, will seal against the lower cowling for adequate cooling.

LONG-EZ/DEFIANT - The mechanical fuel pump has two large threaded holes (fuel in and fuel out) as well as a third smaller threaded hole or vent. This vent port should be vented overboard. If a diaphragm ruptures, gas may run out of this vent. A hose should be run from this vent hole through the bottom cowling, so any venting fuel will not spill inside the cowling.

VARIEZE AND LONG-EZ - Nose wheel pivot. Remove the aluminum collar that retains the nose wheel fork. Drop the complete wheel/fork assembly out of the NG15A casting. Check for wear in the bronze bushings. We found quite a lot of wear on a Long-EZ with 900+ hours, and a couple of builders have reported wear in these bushings that warranted replacement. You can obtain replacement bushings from any bearing supply house. We installed longer bushings this time, for more bearing area and hopefully longer life. These were Oilite bronze flanged bushings, part #FF-838-3, obtained locally in Mojave at the King Bearing store. These bushings were 1" long. We cut them down to 3/4" long to leave space between them as a grease pocket. We also bought (from the same source) two Torrington thrust races parts #TRA-1220. These are essentially large, flat, thin steel washers. They are 1/32" thick and have an I.D. of .752 and an O.D. of 1.240.

We installed one of these between the aluminum fork casting and the bottom flange bushing and one between the top flanged bushing and the aluminum retaining collar. Obviously this takes up more space than is available, so we miked the two Torrington washers, and faced that amount of material off the bottom of the aluminum retaining collar. We

applied a generous coat of grease on all moving parts and reassembled the fork to the NG15A casting. We then carefully adjusted our friction "shimmy" damper until we had approximately 5 lbs. of side force required to turn the wheel. When we tested this set up, we found that the nosewheel pivoted very smoothly, and nose wheel steering now required much less braking effort. At least 5 local EZ flyers have done this modification to date, and all have reported a big improvement. We are pleased with the results of this mod, and have found that we can increase the friction damping force, without making it harder to steer, thus dramatically decreasing the likelihood of shimmy or flutter on the nose wheel.

LONG-EZ - Wheel Pants. We received this idea from a builder. When installing wheel pants on the Long-EZ do not assume that the scribe mark for the axle hole is correct. Cut out the strut hole and tire cutout. Mount the inside wheel pant half onto the aluminum bracket bending as required to position the wheel pant to fit the tire. Fit the outside wheel pant half to the inside sanding edges as necessary.

Drill and tap the axle for a 1/4 x 28 bolt (AN-4) off center to avoid the cotterpin. Cut the head off an AN-4 bolt and thread it into the axle. Build the wood spacer as shown in the wheel pant instructions. Drill a 1/4" hole in the center of it and slip it onto the headless bolt which is sticking out the end of the axle. **SKETCH OMITTED**

Fit the outside wheel pant in place checking to be certain the thickness of the spacer block is correct. Apply flox to the end of the spacer block, sand the contact area of the outside wheel pant and tape the wheel pant halves together. Allow this to cure. After cure back drill the 1/4" hole using the wood block as a guide and countersink for the AN509 machine screw. Remove and discard the headless bolt.

We have had a couple of complaints on fitting the large wheel pants on the Long-EZ. It seems after careful inspection that the left wheel pant is not exactly the same as the right wheel pant. To understand how this could have happened it is necessary to understand how the wheel pants were made.

As most of you are aware the 500 x 5 aircraft tires were not originally approved for the Long-EZ, only the low profile Lamb tires were and they fit the VariEze wheel pants. Then Mike and Sally's Long-EZ N26MS had aircraft tires installed, tested and approved for use on the Long-EZ by RAF. There were no wheel pants designed to fit these tires, so Mike made his own by carving blocks of foam and using the moldless composite method.

These were hand carved using only the eyeball to judge the shape. After they were finished and flying, the results could be judged by the speed increase in the aircraft by 10 knots. Everyone who saw these wheel pants wanted a set and after much convincing, Mike pulled the wheel pants off N26MS and molds were pulled directly from these. In this case the builders got exactly what they asked for. Most builders just fit the wheel pants on and look for the speed increase, all of them that we have talked to, got it. Do not however, get your micrometer out and measure side to side on your wheel pants, you will be disappointed. Instead install them and you will be pleased.

SOLITAIRE KITS
Solitaire essential kits are now in stock and immediately available at both Wicks Aircraft and Spruce Aircraft. Contact them for current prices.

INDUCTION AIR FILTER AD
In January 1985, the FAA put out an Airworthiness Directive #84-26-02 concerning induction air filters. This AD covers almost every civil airplane in the US including homebuilts.

Any induction air filter should be changed at least every 500 hours. This is good practice and all builder/pilots should comply with this. If you are uncertain of how long the filter has been in use, it should be changed within the next 100 hours.

ACCIDENTS
The CP newsletter reports accidents and discusses their conditions and caused for information purposes for all operators. We have always investigated accidents in the interest of determining information that we can disseminate to you, the builders, to help prevent reoccurrence. It should be recognized in our discussion of accident conditions or causes that generally this information is preliminary, since it is published before the availability of the FAA or NTSB accident report.

A Florida Long-EZ was substantially damaged when it struck two power lines while flying level at approximately 140 knots, between two islands. The lower power line removed the main gear entirely, including the attach fittings, some lower fuselage structure and some of the prop. The upper power line cut the upper left winglet off just above the standard rudder. This piece was recovered by fishermen and measured 37" at the leading edge and 27" at the trailing edge. The pilot reported that the impact felt like light turbulence!!

The aircraft was put into an immediate climb. The pilot managed to fly at 600 feet using nearly full right aileron and full right rudder, for a distance of 4 miles over saw grass and trees to a power plant. A 1,500 foot strip of rock and dirt was chosen (all that was available) and a normal off field landing was executed. The pilot was not aware that the main gear had been torn off, so he put down the nose gear and speed brake. The Long-EZ was damaged in the crash landing, but both people on board suffered only bruising from the seat belts and shoulder harnesses. The aircraft was losing altitude and thrust even though the engine was developing good power, due to prop damage. The pilot did a really excellent job in keeping his cool and flying the airplane.

A Connecticut Long-EZ with only 9 hours since new landed short of the runway due to running out of gas and was substantially damaged. With the pilot/builders permission we are printing his report below in the hope that a problem like this can be avoided in the future by other EZ pilots.

"Don Eckbert and I (Richard Marr) built Long-EZ N49EZ over a three year period. It flew for the first time in early March of this year at the hands of Norman Rossignol, a 350 hour VariEze pilot.

The plane had about 9 hours on it when I took it up on the morning of March 19. After about 90 minutes of flight, I noted that the gas in my right tank was getting low. I decided to do a little more sight seeing before heading toward Waterbury-Oxford Airport for a refill. I did not switch to the left tank, reasoning that I should have the airport in sight before doing so, in case I had a water problem.

When I did head for the airport, I forgot about my mental note to switch tanks. As I turned base, the engine quit. I immediately switched tanks but the engine did not restart. The prop had stopped windmilling, we do not have electric start, and I was too low to gain the necessary airspeed to windmill it. I was also too low to make it to runway 36. I hit the slope leading to the runway. The impact destroyed the nose, removed the main landing gear, broke the engine oil pan, prop, carb etc. I got a broken sternum and a squashed vertebra.

I had made two pilot errors. I forgot to manage my fuel and I flew the pattern too low. Another ten feet of altitude and I would have made it to the grassy area in front of the runway without incident.

In all other ways, the Long-EZ is an incredible design. I believe the impact absorbing nature of the composite saved my life. I would not have walked away if it were a conventional aluminum two seater.

The plane is insured so that repair money will not be a problem. My injuries are healing rapidly. My biggest regret is that my partner Don, had little more than an hour in it before the accident. A few years from now (after a Defiant) he will look back on this and laugh. For now, he is contemplating murder.

Thanks again for an incredible design. Richard Marr"

HOT DOGGING EZs - Is The Thrill Worth It?
We have received comments and complaints about pilots flying their EZs at low altitude, over beaches, over ski slopes etc. LISTEN UP GUYS!! It may be fun to buzz when you are in your EZ. You really do feel like you have the world by the tail and nothing can happen to you. No denying it, any airplane that is this small, maneuverable and responsive, will tend to build your confidence. The Long-EZ's flying qualities give the pilot the sense that he is "a part of the airplane" and that he can make the combination fit into the smallest areas with ease. The thrill of this capability has made many of us do dangerous flying.

This must stop. The majority of EZ builder/flyers fly by the rules but some of you are putting us all in jeopardy.

We recently reviewed the data and have found that in seven of the eleven Long-EZ accidents, buzzing was either the primary cause, (like the Florida one discussed in this CP) or a contributing cause. In general, the offender is the one with the loss, but if an EZ is involved in an accident on a crowded beach or ski slope, we are all out of business, no more experimental aircraft flying.

VARIEZE MANDATORY INSPECTION

Before next flight, carefully inspect the lower surface of the fuel tank/centersection area, particularly near the wing attach fitting. We have recently found cracks in the bottom skin running inboard from the wing fitting towards the fuselage, on two VariEzes. We believe the probable cause is over exuberant sanding on the structure before finishing. This cuts most of the way through the glass that ties the bottom of the fuel tank to the bottom of the centersection spar. The centersection spar is designed to handle all bending loads as well as all torsional loads. The fuel tanks take the torsional loads normally, if this glass layup is cut (by sanding), then the centersection picks up the torsion and opens a crack as shown. **SKETCH OMITTED**

If you have evidence of a crack, have someone lift up on the wing tip. This will apply a bending as well as a torsional load and should open the crack, if it is there. If you have any cracks, remove all finish down to the glass for 2" either side of the crack for its full length. Use a strong light to carefully examine the glass structure of the centersection. Look for white fracture lines. There should not be any. If there are, ground the airplane and contact RAF.

Sand the glass thoroughly for a structural bond 4" wide for the length of the crack, and layup 3 plies of BID at 45 degrees across the crack. (Fill the crack or any void with micro first).

SKETCH OMITTED
If you do not repair a crack like this, you will soon have fuel leaking. This repair should be done before next flight.

CLUBS
Lew Nixon is building a Solitaire and he would like to hear from other Solitaire builders, particularly from the Dallas area.

Contact: Lew Nixon
7746 Alto Karo Drive
Dallas, TX 75248
(214)239-6323

Ken Cooley is interested in getting together all Long-EZ builders in north Florida and south Georgia to exchange information and experiences. His hangar is located on the south end of the runway on Hallars Airpark, Green Cove Springs, Florida (Jacksonville sectional). Contact Ken if you are interested. Groups of builders, like Ken is trying to do, have sprung up all over the place, and are really working out well. The moral support as well as the experience available from other builders who may have already done what you are trying to do, is invaluable.

Contact: Ken Cooley
P.O.Box 1346
Orange Park, FL 32067
(904)282-1920

VARIVIGGEN AND VARIEZE PLANS CANCELLED
As of May 1, 1985 the VariViggen and VariEze plans will no longer be available. The sales for these two plans sets over the past few years

have been very low and the current printings have been depleted. We do not feel that the sales justify the expense of reordering.

RAF will continue to provide builder support for those who are currently building either of these aircraft. The supplementary plans, such as engine installation, finishing and electrical system, etc., will continue to be available until we run out of stock.

The Long-EZ, Defiant and Solitaire will of course still be available and we will be supporting these programs just as we have done in the past.

VARIVIGGEN NEWS

The only Viggen builders we have heard from this time is George Craig who dropped by Mojave on his way to Arizona and we saw Wayne Wilkins and Frank Stites and Frank's wife at Sun n' Fun.

Frank flew his new Viggen down from the frozen north to display at Sun n' Fun. It was great to see a Viggen once more on the line. The last time a Viggen was at Sun 'n Fun, as far as we know, was in 1978 when Sally and I flew N27MS in from Indiana. Frank had had his cowling support tube (across the aft cowl, under the spinner) crack and fall into the prop, damaging the leading edge of one blade.

Wayne Wilkins had intended to fly in but had an unfortunate incident just prior to departing Pennsylvania. He pulled his chocks and set them up on the inboard wing. He then climbed in, started her up and began to taxi. One of the chocks slipped aft and into the prop, breaking it. This is a real easy thing to do - be careful - it can ruin your whole day.

DEFIANT PLANS CLARIFICATIONS

The above sketch is correct and the dimensions shown should be corrected in your Section I of the plans. Use this sketch for reference. **SKETCH OMITTED**

Several builders have had some difficulty interpreting how the rudder to nosewheel steering is connected. This sketch should be helpful in visualizing how this is done. The rudders drive NG-8 through RUD-18 pushrod. **SKETCH OMITTED**

NG-8 is bolted to NG-11 which pivots in NG-12 (A-B-C). The 'U' shaped NG-9 bolts to the welded collar end of NG-11. The HM-5 rodend hang down vertically from NG-9. This rodend bolts into the end of NG-10 (the threaded end, or left end as shown on D-41). The spacer NG-10A, slips into NG-10, and this NG-10 assembly is bolted between the vertical "ears" on the top of the Mooney nose gear. The bolt through these "ears" and the NG-10 with NG-10A spacer is oriented fore and aft or parallel to the butt line. This bolt is torqued up tight onto the NG-10A spacer and the NG-10 pivots on the NG-10A spacer when the gear is retracted. This little steering mechanism is designed so that when the nose gear is down and locked, you have positive nose wheel steering. When the nose gear is retracted, the steering is on center and disabled, allowing the pilot to use full left or right rudder pedal

travel without moving the nosewheel side to side in its retracted position.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dr. Julio Moron, of Caracas, Venezuela has completed and flown the first homebuilt of any kind ever in Venezuela. Note how carefully the precious parts are wrapped and loaded on the flat bed truck for the two hour trek to the airport. YV-08X is an absolutely stock Long-EZ and flies straight, true and fast. Congratulations, Dr. Moron!

How about this nifty trailer? C-GSPA, a Canadian built VariEze on its way to the Bow Island Airport. Jim Wallwork built and flight test this beautiful example.

Paul Hington and Steve Morganelli are the builder and flyers of this scratch built R/C model of the Solitaire. This Solitaire has a 120" wingspan, 590 square inches of wing area, (including canard) and weighs 5 lbs. It Flies just like a real Solitaire. At full aft stick, she won't stall!!

Tim Gehres and his wife preparing to start in the Sun 50 Race. This is a high time VariEze, highly modified for racing, and is the prototype for the flush NACA inlet a lot of us use on our EZs today.

Speed demon Herb Sanders prepares to taxi to the start line for the Sun 50 race. Herb beat five of the six Glasairs including three with retractable gear and constant speed props!

Talk about a super sanitary workshop! This is Kjeld Peterson of Tonder, Norway building his canard for the Solitaire.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Ron Southern of Glen Ellen, California, recently completed this example of St. Croix's 1/5 scale model of a Long-EZ. Beautiful!

Johnny Murphy's unconventional Defiant! This example features a fixed Cessna 177 windshield. Workmanship is impeccable.

Jo and Chuck Moore of San Diego, California are moving right along. This shot shows the right wing jigged in position prior to drilling the wing attach fittings to mount the wing.

Jim Glendermann of Frankston, Australia has got his Long-EZ close to completion in spite of an allergic reaction to the epoxy!

Frank Yost, co-builder Tim Crawford (both have completed Long-EZs) and Sally, looking over Frank's Defiant.

Frank Yost's Defiant is in the finishing stage. Essentially all parts are complete. Hopefully he will make Oshkosh '85.

All structure is complete and ready for primer. Both engines are mounted and Johnny is working on cowlings. This shot shows canard being mounted - note incidence level block.

Marty Martindale of Anchorage, Alaska recently completed his Long-EZ. Marty was one of the group of EZ folks who helped Mike and Sally when they had engine problems in Alaska. Thanks Marty.

THE CANARD PUSHER NO 45 JULY 85

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 45. If you are building from 2nd Edition plans you must have newsletters 18 through 45. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 45. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 45. If you are building a Long-EZ you must have newsletters from 24 through 45. If you are building a Solitaire, you must have newsletters from 37 through 45. If you are building a Defiant, you must have newsletters from 41 through 45.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

RAF will be open Monday through Friday, 8:00 a.m. to 5:00 p.m.. Builder support on the phone will be available only on Tuesdays and Fridays, 8:00 a.m. to 5:00 p.m.. RAF will not be open nor will there be any flight demonstrations on Saturdays.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

An important letter by Burt Rutan announces items of interest to RAF homebuilders.

The RAF Aircraft - summary of the era
Rutan Aircraft Factory (RAF) was formed by Burt Rutan in 1969 as a part-time business. Its purpose was the development of a non-conventional research aircraft, the VariViggen.

In July 1974 RAF became a full-time business and moved to a rented WW II barracks building on the Mojave California airport. From that facility the VariEze was developed (two prototypes were built and tested); the manufacturing manuals for the VariViggen and VariEze were marketed, and the special-performance version of the VariViggen was developed. Also, the feasibility study and design of the skew wing AD-1 were done for NASA.

In March 1977 RAF moved into a new facility on the Mojave airport flight line. After that move the Quickie, Defiant and Long-EZ prototypes were developed, as well as several consulting jobs for NASA and the USAF in support of the AD-1 and general canard aircraft technology.

RAF continued the tasks of marketing and supporting the VariViggen, VariEze and Long-EZ programs. Further research aircraft developments continued, including the STOL Grizzly, the self launching sailplane, Solitaire and testing the NGT jet trainer. The Voyager round-the-world aircraft was designed and built at RAF. It was turned over to Voyager Aircraft Inc. in August 1984.

AIRCRAFT DEVELOPED AT RAF

Name	Model #	Design Started	Construction Started	First Flight	Plans Intro'd
VariViggen	27	Aug 67	Jan 68	May 72	Feb 74
VariViggen SP	32	Jan 75	Jan 75	Jul 75	Nov 75
VariEze - VW	31	Sep 74	Feb 75	May 75	None
VariEze	33	Aug 75	Oct 75	Mar 76	Jul 76
AD-1 (NASA)	35	May 76	Dec 77*	Nov 79	None
Quickie	54	Jun 77	Aug 77	Nov 77	None
Defiant	40	Mar 77	Nov 77	Jun 78	Jun 84
Long-EZ	61	Jan 79	Mar 79	Jun 79	Apr 80
Amsoil Racer	68	Jun 79	Feb 80*	Aug 81	None
Grizzly	72	Mar 80	Dec 80	Jan 82	None
NGT Jet	73	Jan 81	Feb 81*	Sep 81	None
Voyager	76	Jun 80	Jun 82	May 84	None
Solitaire	77	Jun 81	Dec 81	May 82	Aug 83

*Construction not done at RAF

The Business Of Homebuilt Plans
RAF has never entered the homebuilt kit market. From the onset, I have limited RAF's marketing to that of plans and support items. It is easier for me to assure the quality of those items. As you know we have been open and candid about the deficiencies that have been found after plans are out and responsive toward developing improvements to fix the problems and to promptly pass the important information on to you homebuilders in the Canard Pusher. The following table lists some interesting statistics in this area.

Model	VariViggen	VariEze	Long-EZ	Solitaire	Defiant
Year plans introduced	1974	1976	1980	1983	1984
Minor corrections	87	164	110	54	28
Safety related improvements	6	40	7	0	0
Improvements (not safety related)	21	115	114	6	8

Most of the items passed along are routine (simple clarifications or corrections), but some have involved real panics, such as our 9-day program to develop, flight test and document the VariEze lateral control system major change in 1977 and our recall of deficient seat belts and 5-month battle with FAA to convince them to issue an AD in 1978.

RAF's early decision to not get into the business of manufacturing parts and kits was based mainly on a desire to stay small and to avoid the responsibility (and thus liability) of assuring that each bolt, wing spar or engine, etc. was perfect. Many people told me I was a fool to not fully gain the financial profits of the designs by not marketing kits. However, the plans business for the VariEze and initially the Long-EZ was excellent and with a low overhead, RAF was very successful, paid lots of taxes and built a reasonable cash health.

This success story worked, however, only on those two designs. The others - VariViggen, Grizzly, Solitaire and Defiant have not been viable in the market place. Even though developed and flight tested, the Grizzly was never offered, because it did not seem that the costs of preparing drawings would be recovered. The Solitaire cost several times as much to develop as the Long-EZ and the market was dismally small, resulting in a major drain on RAF's financial security. The Voyager project was done primarily because I decided that this significant accomplishment would be worth more in terms of the feeling of accomplishment by achieving an aviation milestone, than the more obvious financial income to be received by introducing a new homebuilt. I had thought the the Defiant would be a tremendous success for RAF, because of the excitement it generated upon its introduction in 1978 and because I had found it to be my favorite transportation for nearly 1000 hours of very enjoyable flying. However, this did not prove to be the case, since now at the end of its first year of introduction, after its direct costs of printing, mailing and contract support, its income has not even covered the overhead of one of our 4 RAF people.

We, as well as others in the homebuilt market arena are seeing a market that has been declining in the last two years. Long-EZ sales are down to 20 percent of last years' rate. It is possible that this is due to cost increases but it is also likely that it is due to saturation. Possibly there is a very limited number of people with the persistence to build an airplane and the desire to own an airborne sports car.

Another factor may be the decreased excitement and enthusiasm of the various airshow activities. The new "starwars" homebuilts are not as unique and exciting as they were in 1976. The Oshkosh flyin, once considered the Mecca for the homebuilder, no longer makes him feel welcome, by curtailing flying activities, charging large fees for participating and not providing protection from the general public. Those put off by this, continue to enjoy their aircraft by activities like the IVHC trips and by gleaning the desired utility from them, however, the promotional aspects of the big airshows has declined.

Where do we go from here?

Canard Pushers from 1 to 82

During my 12 years in the homebuilt business arena, I have found that a continuing business of developing homebuilt aircraft and selling plans in the long-term can be self defeating. As the number of new builders grows each year, the number that require support continuously grows to significant proportions. Plans sold in 1974 still get attention for building assistance and the oldest airplanes still need help with operational problems. During the current declining sales period, with our relatively high overhead, we find ourselves spending more to promote current products and to develop new products than income will cover. Thus our long term ability to provide builder support will be threatened unless we drastically reduce overhead.

Recently we were faced with a decision: (1) To continue with the development and introduction of new homebuilts, expanding RAF as necessary for the new development activities and expanding support requirements. We would thus attempt survival (with growth) in a declining market place, or (2) To significantly curtail our overhead to a level to do only builder support. This allows the remaining cash to be available for the longer period of time to support the current builders. Discontinuing further marketing of plans would change our support requirements from an expanding level to a declining environment.

I have decided to follow the second plan. After today, July 13, 1985, RAF will no longer market homebuilt aircraft plans. This should be no cause for concern by those currently flying or building, since we intend, for the foreseeable future, to continue to provide support. Support, as always, will include answering builders mail (SASE required, as always!) and, on a more limited time basis, providing support on the phone. We will also, as before, respond to any requirement for safety-related modifications or improvements, ie., if future experience uncovers any unsafe characteristics or weakness in the plans-configuration, that will be corrected after the appropriate development and test of the correction. Of course, as before, we many not be able to investigate or comment on modifications or options by others that do not relate to a safety question on the basic configuration.

I plan to finance our continuing support effort via the following methods:

(1) Use of funds already directed to subsequent support. We have been using a "deferred income" plan directed at future builder support.

(2) Effective immediately the CP subscription is raised to $14.00 per year. The old price was less than a break-even level for the newsletter alone.

(3) Continue our marketing of support items, trinkets and plans that improve the existing designs. Examples are construction video tapes, owner's manuals, tie tacs, photos and rudder mod plans.

We will be at Oshkosh this year, to market the items in (3) above, but primarily to provide builder support. Activities of a nature to promote new plans sales such as our Saturday demos, aerobatic airshows, advertising, giving rides etc, will no longer be done.

Even though the RAF expenses are curtailed to a minimum level, Mike and Sally Melvill will not be out of work. I plan to use their extensive talents in aircraft development and test in proprietary areas not related to homebuilts.

RAF will be open Monday through Friday for sales of everything but plans. We will no longer be open on Saturdays. Builder support via telephone will be limited to Tuesdays and Fridays only.

It is a difficult decision, of course, to retreat from this homebuilt plans business, since it has been a tremendous amount of fun working with people who also are having a lot of fun. It was a decision made necessary by the nature of the business and our success in the last two years. Also, I have been spread so thin on time, conducting the other business at Scaled Composites, that I have been unable to meet the schedule I had wanted on the next RAF aircraft.

1985 CAFE 400
Gary Hertzler has done it again!!! Congratulations Gary. In spite of a scoring method change favoring speed more and payload less, Gary and his marvelous little 80 hp VariEze managed to defeat all comers. Not only did he win the experimental, two place category, he had the highest score overall of the 38 finishers. We at RAF are very pleased and proud of all the builder/pilots who flew their RAF designs in this year's CAFE 400. When you consider that Gary and his VariEze have won four years in a row and each year the race has been run on a different course and under different rules, Gary and his machine are indeed a special combination - super job Gary, what will you do next year!?!

EXPERIMENTAL TWO SEAT

	Score	A/C Type	Pilot	W/Seat	Speed	MPG	GW	HP
1	2,112,840	VariEze	Hertzler	400/2	150.5	44.82	1200	80
2	2,094,819	Q-200	Sheehan	400/2	175.5	36.66	1200	100
3	1,967,589	VariEze	Savier	400/2	168.5	36.23	1200	100
4	1,740,903	Q-2	Wallrath	400/2	159.8	34.26	1250	100
5	1,649,410	VariEze	Sorenson	400/2	162.8	31.72	1250	100
6	1,646,266	Glasair RG	Hamilton	400/2	199.3	24.58	1850	180
7	1,558,392	Long-EZ	Ellison	400/2	191.1	24.52	1425	160
8	1,513,212	VariEze	Gardner	400/2	172.9	26.98	1300	115
9	1,460,292	Rand KR-2	Alderman	400/2	144.1	32.70	1200	75
10	1,368,148	Vans RV-4	VanGrunsven	400/2	178.5	23.44	1500	160
11	1,358,114	Long-EZ	Kelly	400/2	171.4	24.48	1500	160
12	1,297,052	VariEze	McPherson	400/2	138.4	30.56	1210	90
13	1,228,409	Thorp T-18	Brock	400/2	164.9	23.23	1800	180
14	1,134,420	Glasair TD	Spaulding	400/2	161.0	22.12	1570	160
15	1,115,500	Thorp T-18	Leffe	400/2	172.8	19.90	1840	180

We are very sorry to announce that Michael Dilley will be leaving RAF for personal reasons. Michael has been with us since October 1981. Michael was one of the builders of the Amsoil Racer before joining RAF. Since coming to RAF, he helped complete the Grizzly, then worked full time on the Solitaire. After Solitaire was flying, he was one of the first few pilots to fly the prototype. He worked on the Solitaire

plans for the homebuilders and has been the primary Solitaire builder supporter since the plans were put on the market.

Michael has been building a Long-EZ and has been a great help on Long-EZ builder support. He does plan on completing his Long.

We will miss him very much and he will be hard to replace. But we wish him and his lovely family every success in their future. "We love ya guys".

RAF FLYIN - JUNE 8 1985 - MOJAVE

What a day! The morning dawned bright and clear with little wind (we had all been praying to the Mojave wind gods and they were kind!!) About 7:30 a.m. a bunch of volunteers from the Long-EZ Squadrons I and II showed up and started getting ready for the spot landing contest which they had kindly offered to organize. They barely had their white line painted on the runway, when the first airplane, Bruce and Bonnie Tifft overflew the airfield and announced they were on downwind for the landing. Bruce touched down less than 20 feet beyond the white line and we all began to think that this was too easy! HA!! Not at all, in fact Bruce was the leader for most of the day until finally Bill Oertel of Norco, California landed a scant 8 feet short of the line. The flyin did not really start until 9:00 a.m. but by that time there were 25 EZs tied down on the ramp! After it was all over it turned out that 39 VariEzes and 37 Long-EZs flew in. In addition to this of course there were present on the ramp the 85 percent scale Starship, the Voyager, the Grizzly, the Solitaire and the Defiant. The Gemini, Dave and Kathy Ganzer's unique push pull twin two place was also on the line. The total count of airplanes was 83! This is the largest number of RAF designs ever assembled on one airport at one time, including Oshkosh!!!

A busy schedule, starting with the spot landing contest, then going into a hands on demonstration of composite construction methods, and the finishing of the composites, followed by lunch and the highlight of the day for most people, when we static loaded three different VariEze/Long-EZ canards. A raffle was held for a brand new multilaminate Great American prop, a number of door prizes were given away and the party started breaking up around 4 p.m.

We did not get an absolute head count but we believe we had over 400 people. The hands on seminar was a standing room only situation. Even more people were jammed into the hangar for the static load testing. The first canard was one that was built by a homebuilder and was rejected due to an extremely dry layup. This canard was mounted in a frame (upside down) in exactly the same manner as it would have been in the aircraft.

Thus the static load test was a valid test of the aluminum attach points as well as the composite structure. With Burt directing proceedings, 25 lb lead shot bags were carefully loaded onto the bottom surface of the canard in the proper order and spacing to simulate airloads. Burt called out the load factor at each 2 g increment. At 10 g there was a loud crack as the top skin, forward of the spar cap

failed in compression. The spar cap was still in good shape, so we continued to load shot bags until we were one bag short of a 14 g load on each side, when with a mighty crack, the canard failed catastrophically. All failures were in compression, there was not one tension failure. The attach points (lift tabs) did not fail. At the time of failure, there were 69 bags, each weighing 25 lb loaded on each side of this canard! The tips were deflected an average of about 11 inches. This was 1725 lbs. on each side, for a total load of 3450 lbs hanging on those little lift tabs!!

A dramatic demonstration that surely made every builder feel good about his or her airplane.

We attempted to fail two more canards, but due to the fact that these had been painted white and were shiny and slick (each was airworthy and had over 800 hours of flying time each), we had difficulty keeping the lead shot bags from slipping off. Both went to 12 g with no sign of failure before the load of lead slipped. Interestingly, one side of one of these canards had been deliberately damaged by Burt using a special damage tolerance testing device. The damage was quite severe, enough to have punched deep dents all over an aluminum wing, but in spite of this, there was no difference in deflection from the damaged side to the good side, even at 12 g!!

We at RAF had a really great day and we hope everyone who attended our flyin enjoyed it as much as we did. There were many beautiful examples of EZs on the ramp, presenting a golden opportunity to EZ builders and potential builders to look at and talk to the owners.

We would like to thank all the people who made this flyin such an enormous success, in particular Squadron I and II members. Dick Kreidel, David Orr, Lynn Burks, Joe Orrico and especially Joan Richey. There were many others who also helped. Thank you all, shall we do it every year!?!

We still have some flyin T-shirts in stock. After flyin sale - $5.50!!

The following is a list of the N#'s of the EZs that were on the ramp during the flyin. Thanks to David Orr, whose legs were practically worn to stumps in the 105 degree weather, for tagging each airplane for us.

VariEze		Long-EZ		Odd Ones!
N57EZ	N83VE	N141RJ	N25EZ	Starship N2000S
N3LV	N999EB	N169SH	N82CD	Solitaire N81RA
N57LG	N34VE	N5WX	N661ST	Defiant N78RA
N60SD	N84EZ	N6NG	N26MS	Grizzly N80RA
N183W	N999EZ	N67JD	N711QA	Gemini N75DG
N75VE	N999JD	N218EZ	N27CK	Voyager N169VA
N262DB	N39DP	N7VN	N83DF	The Beez N115EZ
N13EZ	N88RB	N252BJ	N731JS	
N78BN	N7824R	N8JE	N83PJ	
N15LL	N42DS	N324VR	N888EZ	
N450EZ	N99CL	N13YV	N38EZ	
N506D	N15433	N379W	N84LZ	
N23RR	N99VE	N79RA	N89PC	

N80WL	N45846	N15NS	N41AN
N529SK	N45DM	N79YT	N44ZC
N24RW	N64592	N18BP	N102LE
N83DE	N80681	N515DR	N51VE
N27RG	N56RH	N600TD	N55LZ
N33ST	N118SJ		
N139EZ			

If we have missed you, PLEASE let us know.

DEFIANT NEWS
CONGRATULATIONS JOHNNY MURPHY!!!! Johnny flew his brand new Defiant on the evening of June 8, 1985. He was very pleased with the flight, which lasted about an hour. Things were going so well, he even retracted his nose gear, (which is not per plans!). Johnny is the first one to fly a Defiant equipped with constant speed props and he is pleased with the performance. Acceleration during takeoff is noticeably better, climb is better and best of all, the braking effect on final approach as power is reduced and the props go into flat pitch, is quite dramatic, completely eliminating the need for any form of speed brake. Johnny has 3 hours on his Defiant and has put it back into the shop to finish the paint job and all the other little details to prepare it for the trip to Oshkosh.

Frank Yost reports that he is essentially ready for his FAA inspection which will be on the 28th of June. He is planning on making his first flight on the 4th of July and is planning on flying into Oshkosh.

N78RA has been undergoing some major rework. It now has an O-360, 180 hp Lycoming hanging on each end, with temporarily installed Hartzel constant speed props. We have placed an order with Hoffmann for two, three bladed, full feathering, constant speed composite props and are hoping to have them installed in time for Oshkosh. We are presently fitting the cowlings, and hooking up engine and prop controls. We anticipate first flight with the O-360s early July.

Fred Keller has had his Defiant layed up during the winter while he did a complete major overhaul on the front engine. This engine was pretty well run out when he first installed it but due to the rush to make Oshkosh it got pressed into service and operated well for over 150 hours. He has it back in the air and all systems are go for Oshkosh 1985. FOUR Defiants on the line!!!!

LONG-EZ CANARD - RONCZ 1145MS
We are pleased to announce the availability of the plans for the new canard. We have these plans in stock, available for immediate shipment. We are also pleased to announce that Ken Brock Mfg. has all the machined

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parts and weldments necessary to complete the new canard including the two elevator torque tubes, ready to install available for immediate shipment. Contact Brock for prices. The canard plans sell for $42.50. This new canard design is an option for Long-EZ only, it is not recommended for the VariEze. The installation of this airfoil on a

Long-EZ requires the installation of the vortilons on the leading edges of the main wings. DO NOT try to fly your Long-EZ without first installing the vortilons. The canard plans of course include instructions for the manufacture and installation of vortilons.

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

PLANS CHANGES

VariEze - No plans changes, however if you have the early Rosenhaan wheels, brakes and axles, a mandatory inspection of the axles is necessary before next flight. At least two VariEzes have had cracks in the axle at the flange. See Page 7.

Long-EZ

LPC #121, Long-EZ High Performance Rudder Plans.
For new construction only - install the rudder cable conduit in the wing so that the conduit is 1.5" aft of where it is shown on the full sized pattern on Page A-12 of the large 'A' drawings supplied with Section I of the plans.

Defiant

DPC #26
Section I, Page D-32. Aileron Deflection. The ailerons should move up 11 degrees or 1.37" measured at the aileron trailing edge at B.L. 19.5. They should move down 21 degrees or 2.62" measured at the trailing edge at B.L. 19.5. This measuring should be done with the control stick hard over against the stop each way, while approximately a 2 lb. force is exerted towards centering the aileron to simulate airloads. Check both ailerons.

DPC #27
Section I, Page D-57, Rudder Deflection. The rudder should travel 20 degrees each side of center (40 degrees total) or 7.1" left and right as measured at the trailing edge at the top or root of the rudder.

DPC #28
Section I, Page D20, Left lower portion of the page. Green foam block. The 16.5" dimension on each end of the foam block should be 17.5".

SOLITAIRE PLANS CHANGES

SPC #55
Engine Section, Page 21. Electrical system materials callout. Change the lever lock switch SPDT MS25125-A1 to an MS24658-21A (easier to get). Aircraft Spruce has their switches listed by both MS and AN numbers. If ordering from Electric Switch Co, please use MS numbers.
AN3021-7 = MS35058-30
AN3021-2 = MS35058-21

SPC #56
Engine Section Page D-8 and words on Page 7. The length of the hydraulic cylinder with the HF-8 installed should be 23.55 center to center between the pivot points. This requires cutting the HF-8 to 1.5" center of the pivot to the base and cutting enough off the hydraulic cylinder threads to allow the HF-8 to bottom out on the threads. Install the HF-8 with Loctite. Before cutting, extend your cylinder and measure from the center of the base attachment to the start of the threads on the rod in both the extended and retracted positions, add 1.5" to each of these dimensions. Measure the mount from upper to lower pivot points as described on Page 7 of the engine plans. The up distance should be exact and the down can be slightly longer than the closed measurement of the cylinder including the 1.5". CAUTION: Do not cut the threads on the hydraulic cylinder to less than 9/16" and be certain the HF-8 is threaded onto the cylinder shaft fully to the shoulder the threads.

SPC #57 Engine Section, tow release Page 16, and D-23. When installing the tow release unit into the fuselage of the Solitaire it is necessary to remove the inside skin and core material and layup 3 plies of BID lapping 1.5", 1.0" and .75" onto the inside skin. Taper the edges of the honeycomb with dry micro to avoid air bubbles at the edges.

BUILDER HINTS - Finishing Composite Parts.
We have been using a "new" material for the last year or so which was demonstrated and discussed at the seminar held here at RAF on June 8. This material is an epoxy and is manufactured by Gougeon Brothers Inc. 706 Martin Street, P.O. Box X908, Bay City, Michigan 48706. Phone is

517-684-7286. The epoxy known as "The West System" consists of a one gallon container of resin (part #105-B) and a one quart container of hardner (part #205-B (fast) or 206-B (slow)). In addition they sell a real neat little pump system, that screws into the tops of the cans, and dispenses the correct ratio of resin to hardner. This mini pump (part #301-B group B) costs less than $5.00 and is a real time saver. The total cost of a "one gallon" kit with ratio pump is $55.00 (not including COD or shipping charges). When you consider that you have got 1 1/4 gallons of epoxy and you will mix microspheres (glass bubbles) at a ratio of 200 percent microspheres to epoxy, by volume. (1 part epoxy - 2 parts microspheres eyeball is close enough). This in effect gives you approximately 2 1/2 gallons of filler material, the price is cheap.

Sand your glass part with 40 grit. We sand quite vigorously back and forth for about 5 seconds, then sand for a further 5 seconds at 90 degrees to and over your first attempt. This will not destroy the glass structure but will put enough scratches into your glasswork for a good mechanical bond. Vacuum all the dust off the part, and paint a very thin coat of pure West System epoxy all

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over the part. You are just trying to moisten the part with pure epoxy. Wipe half of it off with a paper towel if you get it too wet. Now mix up one pump shot of resin and one pump shot of hardner. Add one heaped full small paper cup (3 oz size) and stir until you have a mixture that resembles cake icing. Use a squeegee to spread this "putty" like mixture all over the part. Make sure you get it on thick enough to slightly overfill any low points, depressions or dings, and also to fill the weave in the glass. Using fast (#205-B) hardner, this dry micro mix will cure in 4 to 5 hours as hard as a rock. Using slow (#206-B) it will take 8 to 9 hours. Once cured it sands very nicely, does not gum up the sandpaper and allows the builder to obtain an excellent contour well within the criterion required to paint the part with Sterling, Mortons Eliminator, featherfill or some similar primer/filler. One coat of one of the above, occasionally two coats, will prepare the part for the primer and then the top coat.

We sand the West dry micro with 100 grit. We then paint on Sterling or Morton with a brush on small parts, or spray it on large parts. When this is cured we sand with 220 grit wet or dry, followed by 320 wet or dry. Your contouring is now complete, and should be as good as you can get it. The gray primer, such as Dupont 131S or Ditzler Preet 33 will not change contour, but when sprayed on, provides a base for the final top coat and does contribute some towards ultraviolet protection. The majority of your ultraviolet protection is provided by the final white top coat, such at Dupont's Imron, Ditzler's Durathane or Dupont acrylic enamel.

The use of the finishing method described above will provide you with a low cost, durable and relatively easy to do finish from the purely physical aspects (elbow grease!). West System dry micro is much easier sand than Safe-T-Poxy dry micro and can be sanded in 4 to 5 hours without gumming up the sandpaper. If Safe-T-Poxy dry micro were used as described above in place of West dry micro, you would probably have

a little more durable surface, but it would be two to three times more work.

This is because the Safe-T-Poxy dry micro is so difficult to sand and takes 3 or 4 days to cure to the point where it can be sanded.

We have done a considerable amount of materials testing and evaluation lately and the general consensus is as follows:

Option 1. Bare glass - West system dry micro - Sterling primer filler with up to 30 percent microspheres - pure Sterling sprayed on as an undercoat - Sterling "U" series, polyurethane top coats.

Option 2. Bare glass - West dry micro - Mortons Eliminator - Corlar 824 S - Imron.

Option 3. Bare glass - West dry micro - Sterling - Preet 33 - Durethane.

NOTE: Safe-T-Poxy dry micro can be used anywhere we have called out West dry micro - it would probably result in an even tougher, more durable surface. However the extra time and effort may not be worth the small gain.

There really is no "best for everyone" system. Take your choice. If you like Ditzler products, by all means use Option 3. If you like Dupont products use Option 2. There are many other excellent paints and finishes, check around, but try to use the complete company system from the dry micro on out to the top coat where possible. See below for a chart on some of the products we have tried. This is our opinion based on actual hands on testing side by side in the same environment, but is not in any way a scientific test. Use this chart as a guide only, then do your own test. **COMPARISON CHART OF FINISHING PRODUCTS OMITTED**

JOBS AVAILABLE
Scaled Composites Inc. needs a Mechanical Engineer and a Structural Composites Engineer. There are also openings in the shop for composite fabricators. An electronics background (experience or hobbyist) is desired.

Contact: Herb Iversen, Scaled Composites, Hangar 78 Airport, Mojave, CA 93501.

Mariposa America Bandstand 50's Fling
Labor day weekend, August 31st through September 2nd 1985. Picnic at the Tiffts hangar, Mariposa/Yosemite Airport. For further information contact:

Marge Tifft - 209-966-2971
or - 209-966-5794

Further details will be printed in the IVHC newsletter. This should really be a great flyin.

SHOPPING

PREFAB GLASS PARTS
Larry Lombard, owner/builder of VariEze N15LL, one of the highest time EZs we know of with over 1200 hours, is now on line and is making Long-EZ main and nose gears and is set up to make Defiant gear.

Larry is working on tooling for Defiant cowlings and fuel strakes and would appreciate hearing from Defiant builders who would be interested in these parts.

He has available tooling for Long-EZ cowlings and wheel pants, VariEze cowlings and wheel pants and can take orders for these parts. We would request however, that if you are ready and need a cowling or a pair of wheel pants, that you contact either Aircraft Spruce and Wicks Aircraft first, since they may still have a few of these parts in stock and we would like to deplete their stock before Larry starts.

Mike Melvill and Michael Dilley flew up to northern California and spent the day with Larry, checking out his equipment and also helped him run the first Long-EZ gear. Larry has built a really nice hanger/shop right on the Boonville airport which is north of San Francisco and west of Ukaiah. He has just completed a first class oven in which to cure the gear. All of the equipment worked well and he is now ready to accept orders.

Larry will be handling all of these parts directly and you should contact him at:

P.O. Box 781
13451 Airport Road,
Boonville, CA 95415
707-895-2718

Larry has a very extensive background in working with composites. He had built several homebuilt aircraft including his own VariEze, and worked here at RAF for two years during which time he helped build the Grizzly and Solitaire. Larry will be working in close conjunction with RAF and we are confident that he will produce high quality parts at reasonable prices.

Aircraft Spruce and Wicks have several new items for sale. The new PR-88 protective hand cream is in stock and sells for $18.50 per liter. Also available is an excellent line of aircushioned drum sanders and flex disc sanders. Contact these distributors for information and prices.

Please note that the catalogs from Aircraft Spruce and Wick Aircraft are now $5.00.

Designed and built by Ian Ayton a Long-EZ builder/flyer, is a real neat plastic NACA cooling vent prefabed and ready to install in your canopy frame or in the side of the fuselage or under the baggage strake. This little gem has an adjustable ramp door that opens and closes to give perfect ventilation. It is made of ABS plastic and can be glassed or riveted into place.

Also designed by Ian, is a little black box that can be wired into your gear/canopy warning system. It will sound your horn in an intermittent

manner rather than a continuous blast. At the same time the warning light will blink on and off. You can override the horn but not the blinking light. However, if after about one minute, you have not moved the throttle to recycle the warning system, the horn will again sound. This is a great idea and could save an embarrassing gear up landing. Mike has installed one on his Long-EZ and is very pleased with it.

Contact: Ian Ayton,
4061 Via Pavion,
Palos Verdes Estates, CA 90274
213-375-9269

NEW BARRIER CREAM TESTED

We recently obtained a new product called PR-88. This is a hand cream designed to act as a barrier against virtually anything the homebuilder might work with. We have found it to be absolutely excellent particularly when working on a dirty, greasy engine, or when painting or working with epoxy. We find it works best if you wash your hands quite often, say once per hour, during a particular job. This also gives you a break and you will find that the work will usually go quicker and better. This barrier cream is the best we have used. It goes on easily and is not sticky and in fact once it has dried, you do not know you have it on. It is available from both Spruce and Wicks.

FOR SALE

Two Lycoming O-360, 180 hp engines, low time.

Contact: Howard Hoenike,
805-366-4912

Continental O-200 engine kit - zero time - needs two cylinders and accessories. $3500.00 OBO.

Lycoming O-320 B2C - 160 hp conical mount (not dynafocal) - 340 hours total time. Disassembled for inspection - no accessories. As is $3500.00 OBO.

Contact: Myron Rupprecht
805-259-1644 - evenings.

VariEze nose and main gear struts and some other VariEze parts. Sell outright or trade for Long-EZ parts.

Contact: Bob Andrews
Box 153
Mt. Uniacki, NS
Canada BON 120
902-866-2759

Defiant nose gear for sale.

Contact: Haley Haynes
795 Seawind Way,
Port Hueneme, CA 93041

Radair 360 Transceiver in excellent condition - just overhauled by Terra. Complete with tray, cannon plug, installation, operational manual and maintenance manual. $375.00

55 amp, 12 volt aircraft alternator and matching voltage regulator. 200 hours since new, includes installation instruction. Made by Motorola/Alcor. Cost $286.35, sell as is for $85.00.

Long-EZ airspeed indicator, excellent condition, graduated for Long-EZ. $30.00.

12 volt electric turn and bank good condition. Made by RC Allen. Sell as is $65.00.

0-2000 fpm vertical speed indicator (rate of climb) works good but glass scratched - as is $35.00.

Potter and Brumfield circuit breakers. 5 amp value, cost $14.00 each, good condition, five c/bs available, as is $5.00 each.

Switch circuit breakers same make as above, good condition, six available, three at 5 amp, three at 10 amp. Cost $22.00, sell as is for $7.00 each.

Zoom cockpit light - red or white, cost $85.00, sell as is $20.00.

Two Cleveland disc brakes, includes discs and brake calipers in serviceable condition (NO wheels) as is $50.00 for the pair.

Two key type ignition switches, one Gerdes, one Bendix with 'start' position. As is $10.00 each.
Contact: Mike or Sally Melvill at RAF 805-824-2645

Squadron I, the original Long-EZ builders group in the Los Angeles basin has a new address and meeting place. They meet once a month on a weekend, usually a Sunday morning on the Bracket Field airport in La Verne. The new address is: P.O. Box 396, Yorba Linda, CA 92668.

WARNING
Non-wood props. Many builders are not aware of the fact that when a new metal prop/engine/aircraft combination is developed, the prop is considered unsafe by the manufactures of the prop and airframe until an inflight stress survey and vibration survey is conducted. The magnitude of the oscillating stress (a function of the airframe - particularly critical on a pusher) is what effects the fatigue life of a metal prop. The only way we get away with not doing these tests on the Long-EZ and Defiant is because the fatigue characteristics of wood are more forgiving. We have installed metal props on a pusher for the first time - the prototype Defiant will be tested this month with Hartzels. We are warned by Hartzel to not fly more than 20 hours before Hartzel does the stress survey. It is possible that the survey will show high stresses and that a different design blade will be required, so we do not know when (or if) anything but the original wood props would be approved.

CAUTION
VariEzes with old style Rosenhaan wheels, brakes and axles. At least two VariEze flyers have discovered cracked axles. These cracks have

occurred in the small radius between the flange and the axles. In one case the crack extended around the axle for over 80 degrees and would almost certainly have failed during the next take off or landing. This is difficult to check for, both wheels must be removed and the flange of the axle should be cleaned and carefully examined for any evidence of a crack. The only remedy is to replace the axles. If you plan on using this design axle for the foreseeable future, we would anticipate that you will need a 4130N steel replacement or at least a 2024T3 aluminum axle with a generous radius (1 1/8" to 1/4") at the flange.

CAUTION
All Lycoming Engines. When checking or cleaning the oil screen, it is critical that the gasket between the oil pressure screen housing and the engine accessory case is oriented correctly. If you should inadvertently install it backwards, you could burst your oil cooler or starve the main and rod bearings of high pressure oil.

Tony Gittes of Guayaquil, Ecuador experienced this problem and went through a lot of time and money trying to figure out what the problem was. Don't let it happen. Pay close attention when you check the screen as to which way the housing and gasket was oriented when you remove it and replace it the same way.

BRAKE LINES
The Nylaflow nylon brake lines which are used on all of the EZs have been generally extremely reliable and on all five of the airplanes here at RAF have performed flawlessly, some of them for more than 10 years. On one occasion we did replace the brake line on the left gear leg of Long-EZ N79RA due to a small blister or bubble that appeared in the nylon line directly opposite the brake disc. At the time we had no insulation on the nylon lines and the heat from the disc heated and softened the nylon line, so that as the brakes were used the pressure blew a small balloon in the line! We replaced the line and insulated them with fiberfrax and silicone and have not experienced any problems. Recently however, we have received two reports of problems with the nylon brake line even though they were insulated. In one case the nylon line blew a balloon and burst causing a loss of brake and a major leak of brake fluid and in the other case, the nylon apparently hardened right at the brass fitting, as though heat was conducted through the fitting into the nylon causing brittleness which due to vibration, broke within 1/4 to 3/8 of the brass elbow.

These are our observations. First of all, the nylon tubing is an excellent, flexible hose, easily capable of handling the pressures required when new and fresh. Sun light is very hard on nylon, the ultraviolet will make it hard and brittle and it then may crack. So keep it out of the sun. When you receive it from the distributor, store it in a black plastic garbage bag until you install it. After it is installed, protect it from sunlight with black electrical tape or something similar. Once you have wheel pants on then the problem goes away.

Protect it from heat. Radiated heat as well as conducted heat can soften the nylon, and also over a long period of time, can cause it to become brittle. Insulate the nylon tube. We wrap it with fiberfrax and glue the fiberfrax on with silicone. Covering the fiberfrax with a reflective aluminum foil such as Reynolds wrap is an excellent idea.

Route the nylon brake line so that it can not "see" the hot disc. Bring it down the trailing edge of the gear leg then around the inboard face of the gear leg into the brass elbow. Do not run the nylon brake line between the gear leg and the disc, this will definitely cause problems. Also it makes it very difficult to change the brake linings!

Last of all, perhaps it is a good idea to install the nylon brake line onto the trailing edge of the gear inside a piece of plastic line, such as hardware store type vinyl tubing or even soda straws stacked together. This allows for easy replacement of the brake line. This is an option not a mandatory change. We have never done this here at RAF, and when we did have to replace a brake line, we found it to be a simple job, but it did mess up the paint job on the gear leg.

VARIVIGGEN NEWS

Wayne Wilkins of Erie Pennsylvania, reports that he has just about flown off his hours and will be flying to Oshkosh. He would like to invite any Viggen flyers from east of where he is located, to fly into his place on July 28th, where he will hangar your Viggen and then you could join him for a flight to Oshkosh on Monday 29th July. Contact Wayne if you can make it. All Viggen builders and flyers are invited to an evening rap session at one of the University lounges in the dorms on Tuesday 30th July. Contact Wayne at 17 Lakeview Ave, Fairview, PA 16415, 814-474-5412.

Len "Dobbie" Dobson reports that he will once again be flying his Viggen to Oshkosh from Georgetown Texas.

Ken Brock Mfg. has asked us to ask all Viggen builders to let him know their parts requirements. The one part in particular is the MG-4 main gear beam. If you will be needing a pair of these parts, or any prefab metal Viggen parts, please let Ken Brock know as soon as possible. This will the last run of Viggen metal parts - don't miss the boat. See you all at Oshkosh.

Shopping Items from RAF

	States	Overseas
Large (2" wide and small (1" wide) Belt Buckles. These are made from laminated German silver with a brush finish. (Available for VariEze and Long-EZ	25.00	27.00
VHS or Beta II Video Tapes Part I - Composite Construction - runs 1:36. Part II - Go-A-Long-EZ. Covers weight and balance, CG, taxi tests and first flight. Some VariEze and Defiant flying - runs 1:05	59.95 ea	59.95
	or 99.95 set	99.95
On the tapes, please add the following for postage	4.00	12.00
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3 ship poster - 17 x 22 - Defiant, VariEze

and VariViggen	3.75	5.00
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White Polo Shirt with Long-EZ or Defiant logo	14.00	15.00
Composite Homebuilt Aircraft Construction	14.50	16.50

*Available in Long-EZ, Defiant and Solitaire. Add state sales tax for California 6%
**Available in VariEze, Long-EZ, Solitaire & Defiant.

All prices quoted above are US funds.

Rutan Aircraft Factory Inc.
Bldg 13, Airport,
Mojave, CA 93501
805-824-2645

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

An aerial view of some of the more than 80 RAF types that flew into Mojave - RAF building is the small one on the right, Scaled Composites on the left.

WOW! How about this? Don't ask! The owner/builder designed and built it himself and he is still testing **4 BLADE PROPELLER**

Some very beautiful examples of EZs were parked on the ramp affording "would be" builders and unparalleled opportunity to look and talk to owner/builders. Photos by Doug Shane.

About 3.7 g so far. Burt is standing by to make sure we place the bags correctly.

Right at 12 g. At this point there is 3000 lbs of lead shot on the canard - all suspended from the "little aluminum" lift tabs! Deflection at the tip is around 10" on each side - scary!

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Don Downie shot this photo, which shows 73 EZs, a Grizzly, a Defiant, a Solitaire and a Gemini.

Chris de Brichambant of Ramonville, France (holding under left canard) with his team of young people (average age 23 years) who built this beautiful Long-EZ. This airplane will fly from France, over Spain and West Africa, across the Atlantic to South America and then to Miami, Florida with a possible stop at Oshkosh during the convention. Good Luck Chris.

Beau Wold's outstanding Long-EZ in formation with his St. Croix model Long-EZ - neat!

This incredibly accurate R/C model of Burt's prototype VariViggen was built by Gene de Kook, Canadaigua, NY.

Jeff and Dave Rodrian, two of the reasons their Dad is building a Defiant, inspecting the bottom skin of their canard.

Dr. George Best's Defiant is making good progress - this shot shows the nose gear and nose gear well - fuselage is inverted.

Mike Cardinale, Defiant builder, installing his main gear for the first time.

Roland Othin-Girard, Sevres, France, with four helpers, getting an idea of what their Long-EZ will look like.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Going for the white line in the spot landing contest!

Careful now! Going for about 13 'g'. This rejected homebuilt canard failed at 13.8 'g'.

Pat Krause is the "Glorious Pilot" and Lou Faix is the "Lowly Mechanic" in this Long-EZ team - a sign of the times?

PHOTOGRAPHS OF VARIOUS RUTAN DESIGNS OMITTED

THE CANARD PUSHER NO 46 OCT 85

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 46. If you are building from 2nd Edition plans you must have newsletters 18 through 46. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 46. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 46. If you are building a Long-EZ you must have newsletters from 24 through 46. If you are building a Solitaire, you must have newsletters from 37 through 46. If you are building a Defiant, you must have newsletters 41 through 46.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
Most of our time since Oshkosh has been spent working on the Defiant engine modification. We removed the 160 hp O-320's and have installed 180 hp O-360's. Baffling these engines, hooking up controls, modifying cowlings to fit and modifying the instrument panel with the attendant rewiring has been quite a job. Since Michael Dilley left, Mike Melvill has been working on the Defiant until this week then Jerry Moore, an experienced glass laminating man joined us. Jerry has been working on the Defiant and will be working on the new projects as they come in.

RAF has been wound down to using only one office and no shop space in building 13. An independent division of Scaled Composites has been formed, called Composite Prototypes which now occupies building 13. This division will be building prototype composite aircraft for other

companies as required. Composite Prototypes is much like a smaller or scaled down version of Scaled Composites.

OSHKOSH 1985
RAF designs once again were far and away the most numerous on the flight line. Irene "Mom" Rutan counted 54 VariEzes, 57 Long-EZs, 3 Defiants, and 3 VariViggens during the week of the flyin. 9 VariEzes and 5 Long-EZs did not register. Come on Guys, it costs nothing to register and it helps RAF in the official count. A total of 117 RAF type airplanes were at Oshkosh during the week. "Mom" of course is the International VariEze Hospitality Club Historian, and she takes pride in the fact that she knows most EZ flyers. PLEASE, Irene would like to hear from all builders after their first flight and she would really like to have a photo of your airplane for her very extensive photo albums.

This years flyin was "bigger and better" than ever, more noisy warbirds then ever! Apparently this is where the money is, as this is what we are told that the public wants. The weather was excellent all week and the crowd, particularly on Saturday and Sunday were enormous. The Concorde was really spectacular and made a nice change. Quite an innovative aircraft with many interesting features. Note that in 1984 the Voyager was the 'Concorde', ie; the special new attraction that provided the excitement.

The IVHC dinner was once again a full house and as usual was the event of the week. This is an evening to renew old acquaintances and meet new EZ flyers. The "real" George Scott was again the organizer and did his usual fantastic job. Unfortunately this was George's last year of hosting the IVHC dinner. We shall really miss him. Thank you George and Dolores for all of the years you have given so selflessly to our organization, you guys are really something. Don and Bernadette Shupe presented a special award to George and Dolores. Shirl and Diane Dickey tied with Don and Edna Foreman from England for the Ed Hamlin Memorial Award. Don and his son Jamie were on hand for the presentation and gave us a very funny account of his role as IVHC representative in England. Apparently U.S. EZ builders continuously arrive at the Foreman's for one or two nights and spend a fortnight! Don was the first to complete and fly a VariEze in England, he was also the first to complete and fly a Long-EZ and is rapidly approaching completion of a Defiant - sounds like a certain Florida fellow we all know and love!! If you are not already a member of the IVHC, do yourself a favor, write to Don and Bernadette and join up. Its a fun group and everyone understands EZ talk!
Don and Bernadette Shupe, 2531 College Lane, La Verne, CA 91750. The dues are $8.00 per year.

A number of you have asked if RAF will continue to attend the EAA convention at Oshkosh, Wisconsin. We consider that the face to face builder/operator support function that is experienced at Oshkosh is extremely important to the continuity of the flight safety of all the homebuilt aircraft. The pilots bull sessions, personal builder support sessions and the opportunity to inspect the wide assortment of completed aircraft, is an important factor that should not be overlooked. EZs at Oshkosh 1985 totaled 117, more than 3 times the number of the next most common homebuilt. The candid discussions we are able to provide as well as the communication that prevails at the

IVHC banquet is an item we do not plan to abandon. Look for us at Booth G-7 next year operating in the same role as in 1985 and also look for us at the various flyins that emphasize homebuilt aircraft, such as Watsonville and Jackpot.

After Oshkosh, the Voyager crowd, Dick, Jeana, Bruce Evans, Sue Bowman and Wanda Wolf and Mike and Sally flew up to West Yellowstone airport, just west of the National Park. This is a fabulous place to visit, the airport is excellent, the people friendly, the hotel comfortable and reasonable. We rented a station wagon and drove into the park, where we wandered around watching most of the geysers. This is really a neat place and a "must visit sometime" trip. Perhaps in IVHC flyin?

We all arrived home safely and as far as we know, so did all of the EZ types, although Bruce and Bonnie Tifft had quite an experience at Cheyenne, Wyoming. They made an overnight stop and were caught in that incredible hailstorm/flash flood. They were unable to get their EZ into a hangar, so it sat out through the worst of the storm. Fortunately there was little damage, although the hail made tiny little dimples all over the airplane. During the height of the storm, Bruce says the rain flooded the ramp to the point that his wheelpants were completely under water. That Imron must be tough paint!

JACKPOT FLYIN, 1985

Shirl and Diane Dickey once again hosted and organized the most enjoyable flyin of the year. A total of 42 EZ types flew in to this neat place in the extreme northeast corner of Nevada. Cactus Pete's Casino made all of us feel welcome in their beautiful hotel/casino. Burt flew up in his Grizzly. Old Grizzly really did look strange parked in the middle of the EZs! A special treat for us 'old' EZ folks was that we were able to share the weekend with Joanne Hamlin.

The flyin was over the 4th of July weekend with most of those attending flying in on Thursday evening and flying home on Sunday. The weather was great and of course the favorite spot for hanger flying was around the pool. A dinner show was enjoyed by all on Friday, and Saturday was race day. The Jackpot races really do show who has the fastest EZ.

Klaus Savier flying Larry Godsey's VariEze set a new course record with an unbelievable 205.28 mph! Shirl Dickey posted a 197.59 mph lap, a dramatic improvement over last year. Earl Wilson won the unlimited EZ race in his VariEze defeating several "big engine" Long-EZs.

Early Sunday morning, some folk heard what sounded like another race. It turned out that a 'grudge' race was being run. Klaus Savier in his VariEze challenged Ed Kelly in his Long-EZ - Ed Kelly won. We're sure that this will also become an annual event!! Bob Hansen won the spot landing contest, and Mike Melvill flying the prototype, N79RA tied with Shirl Dickey in the ribbon cutting contest.

Anyone who has not attended the Jackpot flyin really is missing one of the neatest EZ get togethers there is. You owe it to yourself to try to make it next year. Once again Cactus Pete's put up a very generous

cash purse for the races and quite a number of EZ flyers went home with money in their pockets. 24 VariEzes and 17 Long-EZs and one Grizzly were counted for the weekend.

Here are the race results:

Standard VariEze

1.	Klaus Savier	35:38:89	205.28
2.	Shirl Dickey	37:02:44	197.59
3.	Rich Clark	38:51:43	188.36
4.	Gerry Gardner	39:39:87	184.50
5.	Gene Zabler	40:25:38	181.07
6.	Steve Sorenson	40:50:81	179.17
7.	Bryan Giesler	42:46:64	171.09
8.	Don Youngs	43:40:19	167.61

Standard Long-EZ

1.	Dick Kreidel	37:49:43	193.50
2.	Ian Ayton	40:08:66	182.31
3.	Gus Sabo	40:15:83	181.76
4.	Bob Hansen	40:45:63	179.55
5.	Mike Melvill	41:19:02	177.17
6.	Bob McCoy	42:03:84	173.98
7.	Jerry Bugni	42:21:44	172.80
8.	Debbie Iwatate	44:22:81	164.91
9.	Frank Tifft	44:53:52	163.04

Unlimited EZ

1.	Earl Wilson	36:56:32	198.15
2.	Jerry Sloan	37:08:06	197.12
3.	Sam Kreidel	38:17:62	191.12
4.	Wes Gardner	38:24:26	190.59
5.	Dave Werner	39:26:05	185.62
6.	Bob Paulsen	39:43:31	184.27
7.	Larry Nogele	39:48:66	183.83
8.	Ed Kelly	41:01:11	178.45
9.	Lynn Burks	41:34:84	176.00

CLUBS
Arnie Ash reported an excellent turnout for EZ types in the central part of the country. The flyin/drive in was organized and hosted by Arnie who says that 17 EZ types flew and over 70 people enjoyed the kind of a weekend only EZ people can. Arnie is trying to organize a builder/flyer group in the area and is planning on holding another flyin next spring. Anyone interested in joining this group and receiving their newsletter, contact: Arnie Ash, Route 5, Davenport, IA 52806. To join the group is a cost of $10.00 per year.

RAF BUILDER SUPPORT
The most asked question these days is how long will RAF remain in existence to support the homebuilder? The answer to that question depends largely on you the homebuilders. We will be here as long as you support RAF, that is to say, you send in information on your project, photos, builder hints, safety/maintenance related information

on your aircraft and you continue to subscribe to the Canard Pusher newsletter. Now that RAF has zero income from plan sales, its important that you support RAF by buying your raw materials, prefabricated metal parts, or prefab glass parts from RAF approved suppliers, such as Aircraft Spruce, Wicks Aircraft, Ken Brock, Lombard's and Dayton Airplane Factory. This will go a long way to making sure RAF is around for many years since RAF gets a small percentage of your cost from each of these suppliers. If you elect to buy your part or supplies from one of the "bootleggers", you are contributing to the demise of RAF and we will not be here to support you should you have a problem while building or flying your RAF design.

If you buy from non-recommended suppliers, you are not only not supporting RAF financially, but you also do not know if you are getting correct materials or safe parts. When you buy from RAF recommended suppliers, you are absolutely getting RAF recommended materials and parts we have tested and are happy with.

It is up to you the licensed homebuilder. If you want RAF to be around to publish the Canard Pusher, to help when you have a problem, support RAF. Send in your builder hints, your photos and flight reports. We will be here as long as we possibly can to assimilate and disseminate safety information and to try to promote the safe building and flying of our various RAF designed airplanes.

HOMEBUILDER MODIFICATIONS

Recently we have noticed a trend towards homebuilder modified Long-EZs, particularly the long nose and heavier engines. These are not RAF approved modifications and we are concerned that most pilots may not be aware of what they could possibly be getting into. First of all, the longer nose IS destabilizing in pitch as well as directionally (yaw). How much of it may influence your particular airplane is not known. We believe you as the pilot should know just how stable your own airplane is. We strongly recommend to anyone who has modified their own aircraft in this way, that first of all you should install vortilons on the main wings. The vortilons allow a little more stall margin. Secondly, you should put on a parachute, and climb to at least 10,000 feet above the ground and at that altitude, you should fully explore the stall/full aft stick characteristics of your airplane. Do it first at a mid cg position, then ballast to the aft limit, (103") and do it again. In this way at least you will be aware of any possible unpleasant stall behavior or unstable tendency, and you would be a lot less likely to later discover any nasty trait at low altitude with no margin for a safe recovery.

We are really concerned when we hear that a particular builder has done a major modification to his airplane. For example, a larger, heavier engine and a longer nose. Then he goes out and flies it for a few hours and then tells all the builders in his area what a neat thing he has done. Now some of these builders decide, based on his results to do the same thing. Meanwhile, the original experimentor never did test his airplane at aft limit cg, at full aft stick, with aggravated control inputs, or at the red line or at limit g so he never knew for a fact that his airplane was safe. Another builder, influenced by the first experimentor makes similar changes, goes out and while demonstrating the much touted stall characteristics to a passenger, enters a deep stall condition at low altitude, does not have enough

room to recover, and so he and his airplane become another statistic and make not only the Long-EZ look bad, but also puts a blot on the accident record of all homebuilts.

To sum up: If you must make changes to your aircraft, keep in mind that you now have a different airplane than the original plans built Long-EZ prototype. Your new design may have perfectly safe aft cg, high angle of attack flying characteristics, but it may also have unsafe, nasty characteristics, just waiting to bite you at an inopportune time. To protect yourself, and any

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future passenger you may take for a ride, 1) you should install the vortilons, 2) you should thoroughly test your airplane at aft cg, high angle of attack (full aft stick) with aggravated control inputs. If your airplane does not handle well, limit your aft cg. You do not have to go back to the published limit. If you are not comfortable at 103, try 102 or 102.5. If it is good there, limit it there, note it in your log book, placard the airplane, and don't ever exceed this (or any other) limitation. Remember, each Long-EZ, or any other homebuilt design, is different. Don't assume because Joe Blow did it and was safe, that you will be. You may not be and that really can take the fun out of the whole project. Don't ever lose sight of the fact that, that is what this whole thing is about - having fun!! FLY SAFE AND ENJOY.

NEW RONCZ 1145MS CANARD UPDATE
Quite a number of these plans have been sold now and we have been receiving lots of feed back. There are several small errors in the plans, (see this issue, Long-EZ plans changes) but generally most builders have been doing real well building the canard.

There are at least three flying now, the first homebuilder to notify us that he was flying his new canard was Harold Martindale of Anchorage, Alaska. Harold called after his first flight during which he had flown in and out of several rain showers and was delighted with the lack of trim change.

One of the errors in the plans has caused a few people to build a shorter canard by 2". This is not good. The elevators are shown the correct length, the elevator torque tubes as provided by Ken Brock are the correct length. Do not cut your elevators down. If you have built your canard too short (Page CI, 64" dimension should be 65", 10" dimension should be 11"), you will need to glue a 1" piece of foam to each end of the canard, carefully sand it to match the airfoil shape.

Mount the elevators, then proceed according to the plans, with the shaped wingtips. Now, when you glass these wingtips, simply run the two ply layup on the tip over the 1" foam addition onto the canard. Do this top, bottom and trailing edge and your canard will be the proper length.

Do not cut down the length of this canard. There is apparently a rumor being put out by someone in the Florida area, that you can vary the length of the canard depending on your weight. This is absolutely not

true. We have tested this airfoil section at various lengths and the length called out in the plans is the optimum length and should not be changed.

Do not neglect to install the vortilons on your main wings - vortilons on the main wings are MANDATORY when using the R1145MS canard. They are optional when using the original GU section and we have had reports varying from no change to "really makes a big difference" with the original canard. Try them and see.

FROM THE BUILDERS
From France, Chris de Brichambant reports that his beautiful Long-EZ has set a world record from Paris, France to Tunis, North Africa and back, non-stop. This is a distance of 1600 nautical miles at an average speed of 126 knots using only 52 gallons of gas. This gives a very respectable 30.8 nautical miles per gallon. Congratulations to Chris and all the folks who helped build this gorgeous Long-EZ.

From England, Bill Allen won best composite airplane at the Popular Flying Association's Rally, the English equivalent of Oshkosh. There were 17 EZs at this flyin and Bill topped them all. Congratulations Bill.

N26MS, MIKE AND SALLY'S LONG-EZ - the first 1000 hours.
As many of you (who attended the RAF flyin in June and also Oshkosh this year), will know we have given our "old" Long-EZ a face lift. It is hard to believe, but she will be 5 years old this December.

It all started when Mike decided (and the check book said ok) that we needed a Loran C!! After much looking around, we opted for the MicroLogic ML6500. Our reasoning included, easy to operate, fully automatic chain selection and a size and shape that would fit our panel. It turned out that the panel had to be cut out and a completely new one be designed, built and installed! While we were at it, we tore out all the wiring (it was done in a hurry and Mike was never very happy with it). Our panel night lighting was never very good, so we installed post lights over all the instruments, as well as a dimmer switch. Panel lighting at night is now superb.

In order to do all this work, we removed the wings and canard, cut out the side consoles, cut out the instrument panel, reshaped the nose to allow installation of brake master cylinders up front and optimum placement of the two 12 volt motorcycle batteries, that make up our 24 volt electrical system. We also reshaped the cowling extending it aft a full 3" to reduce the closure angle and hopefully reduce drag a bit.

The structure was given a very thorough inspection, wing attach hardpoints looked like the first day they were put together. We are extremely pleased with the composite structure. A few small cracks were found in the paint, all were examined, by removing all finish down to the glass. In no case did any crack extend into the glass, we are ashamed to admit that each crack was over a rather generous build up of Bondo! The moral here is use dry micro not Bondo. We did a little recontouring, filling with West System, sanding and priming with Mortons Eliminator. We installed the new Roncz 1145MS canard, carefully fairing it into the nose. We designed and built two battery access doors (they work nicely, but are not worth the amount of work it

took). We installed the Loran C antenna in the left winglet. Then we wet sanded the original Imron finish down until the whole airplane was dull.

Mike sprayed the entire airplane with Imron using a slightly whiter white than we used last time, and we trimmed it in metallic gray instead of the green we used the first time. We had the seat cushions recovered in gray to match the trim. All the consoles were glued and glassed back into place, the interior was once again painted in charcoal gray Zolatone. We installed the Ian Ayton's canopy/gear warning systems, (it flashes the warning light and buzzes the horn intermittently). We cannot say enough about this system. It is really neat. It is small, easy to install and you absolutely cannot ignore it. If you override the horn, the light continues to flash, and in about 50 seconds, the horn starts to buzz again, a very worthwhile addition and one we both heartily recommend.

When we finally reassembled her, she looked like new! We did a careful weight and balance on 3 certified aircraft scales (naturally she had put on a little weight), then we rolled her outside, fired her up and went flying.

The whole face lift was supposed to take a few weeks and in fact ended up taking over three months. (It only took 5 1/2 months to build her from scratch!!)

The Loran C works well. We get SNRs (signal to noise ratio) of 99 on the master as well as both slave stations, with everything turned on, engine running and in flight. This is true in the Mojave, Bakersfield, Fresno area at least where the testing was done. Obviously there are many places where we cannot get these kind of optimum results. The antenna we use is a 3/16" O.D. hobby store brass tube. We sharpened the end, put it in an electric drill, and "drilled" it into the bottom of the lower winglet, pushing it all the way to the top of the winglet. It goes up the leading edge of the upper winglet. We soldered the preamp to the bottom of this brass tube, removed a wingtip light assembly, dug out a little foam and installed the preamp behind the wingtip light. We are very pleased with this simple, cheap antenna.

We recently installed miniature fuel and oil pressure gauges (1 1/4" dia) that read actual pressure (not electrons!). They are plumbed directly from the engine to the instrument. We used nyloseal tubing fittings. These are really great little instruments, a bit expensive, but worth it. (See page 206 in the Aircraft

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Spruce catalog). In addition we have an Electronics International digital CHT-EGT with a four way switch, so we can look at all four cylinders. We bought an oil temperature probe and connected the cylinder #1 EGT to the oil temp. Thus we have 4 CHT, 3 EGT and oil temperature in one gauge. Also in this small side panel, is a digital voltmeter by Davtron. Again, expensive but worth it. We know exactly how the electrical system, alternator charge, etc is doing, plus or minus 0.1 volt.

The only item that really required maintenance was the nose gear strut and associated pivots. Mike removed the top bolt and took the whole strut out. The bushings in the NG-6 assembly (NG-23 as shown on Page 13-1) were quite worn allowing considerable side to side play in the top pivot. Mike machined up two steel bushings, pressed them into the NG-6 casting then reamed them to be a very close fit on the NG-7 spacer. A grease fitting (Zerk) was installed in the NG-6 casting allowing future lubrication of this pivot without dismantling it. The two HM-6 rodend bearings in the shock strut were also somewhat worn, allowing some fore-aft movement of the nose gear strut. We replaced these rodend bearings with very expensive aircraft quality rodend bearings (approximately $25.00 each) which essentially eliminate any play.

The vertical pivot at the nose wheel fork had already been overhauled per CP 44, page 7. Thus the entire nose gear strut and wheel has received a complete major overhaul. It is now working flawlessly and we are very pleased with the above modification and repairs.

The brake master cylinders up forward modification was done for three reasons: To help move the CG forward, to allow better access for inspection and hydraulic fluid replacement, and to also allow better access to the magnetos.

Mike designed this particular installation, it works quite well, but if we were to do it again, we would use Debbie Iwatate's method. (See "for sale" this CP).

We did find one drawback to the forward mounted brake cylinders, that we had not foreseen. It is now quite difficult to adjust the rudder position for various size pilots. The original design used only adjustment to lengthen or shorten the cable aft of the pedal. Now we have to also adjust the pedal to brake master cylinder relationship, which with our design is awkward. As a result no one else gets to fly our Long - advantage or disadvantage?!?!?!

We have also done a lot of work on optimizing engine and oil cooling. At this point in time though it is too early for us to comment on the success. We are flying the airplane quite a lot, in fact since Oshkosh we have put over 100 hours on her. N26MS continues to meet or exceed our expectations. We have enjoyed nearly 5 years of fun flying, visiting faraway places and meeting interesting people. We are looking forward to the next 1000 hours.

FUEL VALVE STICKING PROBLEMS
During the past 1000 hours of operation in N26MS, we like many EZ pilots have had problems with the fuel valve becoming stiff with time. We have used Parker Fuel Lube for about 3 years, but this has been a temporary situation at best. In fact lately the Parker Fuel Lube only lasts a few weeks, then the valve is just as stiff as before. This is a bad situation, and could even become a dangerous situation.

Recently Dick Kreidel, past president of Squadron I in the Los Angeles Basin area, introduced us to a new grease. This material is very expensive, try almost $800.00 for a one pound can!! Dick gave us a minute amount, enough to cover your thumb nail, and frankly we thought, what a scrooge! Wrong! This is in fact probably a life time supply.

Seriously, we ran the Long-EZ down to two or three gallons of gas on each side. We raised the nose as high as we could to get the fuel valve above the fuel level. We tied the nose down to avoid having it fall on its tail and then used a small ladder to reach inside and disassemble the fuel valve.

We removed the whole thing and noticed signs of 'galling' on the tapered brass valve. We cleaned it thoroughly and "lapped" the valve using jewelers rouge. Brasso metal polish or something similar would also work. Then we cleaned the valve and parts and applied the new "Kreidel" magic grease sparingly all over the tapered brass valve. We reassembled the valve and greased the "detent" mechanism. We had also in the past removed a small amount off the length of the spring. This was done by carefully grinding about half the wire thickness in the spring on each end of the spring on a grinding wheel. Don't get the spring too hot or you will ruin the temper.

We reinstalled the valve and have now got over 80 hours operation over a period of a couple of months since the "lube" job. The valve literally turns like it was on ball bearings. We are very satisfied with this system and heartily recommend it.

Obviously, at $800.00/lb this grease is not reasonable for each individual to purchase, so we (Mike and Sally) have bought a small can of it and we would be happy to send a "small" (literally less than 1/2 teaspoon) quantity to any builder or EZ flyer who will send $10.00 to us at RAF. The $10.00 will cover the cost of a small plastic container, a jiffy bag, postage and cost of the grease. It is on back order at the time of this writing, and should be in our hands November 15, 1985.

Dick Kreidel has been using it for almost two years (over 500 hours) in his beautiful Long-EZ and he says that although it does eventually wear down to where the valve starts to get a little stiff, he says it seems to last longer with each application. He has only greased his twice in 500 hours.

LORAN-C, SOME PERSONAL OBSERVATIONS

I am new to Loran-C and like most pilots I had heard the glowing reports on how great it was and how it would replace VORs. I never did read or hear any negative reports, so like many others I talked Sally into us spending the necessary dollars and before you could spell Loran-C, we had a MicroLogic ML6500 in our Long-EZ!!

I have used it on every flight for the past 4 months and the following observations are strictly my own for the better eduction of other pilots looking at Loran-C.

Before you buy a Loran of any kind, find out if your area is good for accurate Loran coverage. While Loran navigation is good in some areas, it can be essentially useless in others. I am not talking about the mid continent gap either. Ask your dealer to explain base line extension. This is in simple terms, when your airplane is positioned so that two of the three necessary stations "line up" thus giving the receiver on board excellent information in one plane and zilch in the other plane. This causes the unit to flash an unreliable signal and to give crazy ground speed readouts of as much as 50 knot errors and cross

track errors as much as 40 miles. Distance to the stations remains somewhat reasonable, but still questionable and therefore for practical, accurate navigation, probably useless, especially in marginal rainy weather, when the rain upsets the Loran somewhat too, must to static? I have experienced this exact scenario many times in the area between Bullhead City, Arizona and Prescott, Arizona. Certainly this is not in the mid continent gap. I assume this to be classic baseline extension gremlins at work.

My other pet gripe is the fact that I can be flying along wings level with SNRs of 99 on all three stations, with all data showing good. I see something below that I would like my back seat passenger to see so I bank quite steeply to give her a better view and when I roll back to wings level on the original heading, the Loran has lost its mind. Ground speed is way off, cross track error is miles off, only distance to the station is reasonable. According to the manufacturer, this is due to the fact that the microprocessor does not update fast enough, and with the information changing rapidly due to the heading change, the computer does "tilt". It takes about 2 minutes of straight and level flight before the information is reliable again.

Oh well, nothing is perfect! In good Loran reception areas this is a neat navigation tool, but don't throw away your VOR equipment yet. Loran-C is very accurate provided it has been there before. That is to say, my Loran receiver has my hangar's position absolutely nailed. It will bring me back to the hangar plus or minus 60 feet (actually its more accurate than that in Mojave). If you look up the Lat/Long of a given airport or VOR in your handy Loran booklet, and dial it in, your Loran will sometimes bring you right to the spot, but most times will bring you only to within a mile or two. In VFR conditions you can always see where you were trying to get to.

I have found the distance to the station to be the most useful and reliable information displayed by my Loran receiver. If it's been there before and you are in a so called good area, it's great! I have talked with pilots who fly Apollo IIs, Arnav 21 and SRD Labs Loran-C receivers and generally they have had the same results I have spelled out in this article.

I would be interested in hearing from others with their experiences. I do not intend to discourage anyone from buying and installing a Loran, rather I hope I have given you food for thought, allowing you to make an intelligent decision and to help you understand some of the "quirks" of the so called 'lower-priced' Loran-C receivers. I have essentially no experience with the so called 'pro-line' type Lorans($5,000.00 and more).

Generally speaking, I like my Loran. It is a neat navigation aid. I enjoy using it and most of my cross country flights are probably flown more accurately therefore my airplane is more gas efficient. As I get more familiar with it, learn about its good points as well as its bad points, I get more out of it. Would I do it again? You bet!! Mike Melvill

Following letter is from Judge King, a Minneapolis, Minnesota Long-EZ builder/flyer. Judge installed an Arnav 21 Loran-C receiver in his Long and from my conversations with him, he feels about the same way about his as I do about mine.

Retrofit A Loran-C For Your EZ - by Judge King
The stories I had heard about the problems of installing Lorans in plastic airplanes almost discouraged me from attempting a retrofit for my Long. There were the ongoing antenna problems and the problem of where to put the unit. Claims of no panel space are a myth if one plans well in advance.

I decided to plan a Loran installation because the price was right compared to the new equipment that depends on VOR signals. I ignored all the stories about Lorans and electrical interference and did nothing special during my installation to eliminate problems discussed in many articles related to strobe lights, alternators etc.

The antenna is a straight piece of RG58 co-ax cable four feet long and installed in the winglet on the left side of the airplane. The top 24 inches of the cable is stripped of its outer insulation and shield. The lower 24" portion plugs into the preamp. Putting this in the winglet during construction would be a snap. It is also a snap in a retrofit.

1. Remove the position-strobe light assembly exposing the hole in the wing for running wires. If your Long was built per plans this hole is forward and below the upper winglet.
2. Using a .25 x 4 ft drill bit (the kind that burglar alarm installers use) drill a channel through this hole from the inside into the upper winglet staying as close to the leading edge of the winglet as possible. (My channel wandered and the drill bit came out the top of the winglet about half way aft). It is important to note that this hole is being drilled through a structural attachment point so one small hole is enough. The antenna co-ax was pulled through from the top.
3. Placing the preamp. Since the preamp has to be attached at the end of the antenna a cavity was carved in the same space behind the strobe light assembly to accommodate the preamp. (There is only styrofoam in this area - thus an easy carving job). The distance from the preamp to the Loran is less than 25 feet of fishing cable through the wing and center section spar and fuselage.

I had no cable fishing to do because I installed a comm antenna in the left winglet during construction which I never used, so I used the RG58 cable that was already there. With my antenna installed I turned to the problem of where do I put the unit. I got rid of my ARC radio and VOR head, lowered my transponder by 1" and was able to fit my 3.1" Arnav at the top of the stack of my new TXN960 (720 channel radio with locator and glideslope and VOR head all in one unit) and transponder.

The Arnav unit is higher than some other units but I was determined to make it fit because it has some features that others are lacking. I don't have to ask flight service for winds aloft anymore and I was aware that Arnav was in the process of a new safety feature which I just ordered for my R-21. Enroute to a distant waypoint I can punch in

911 and get immediate indication of bearing and distance to the nearest six airports.

Flying the VORs was great when that was all I had but I consider my R-21 Arnav the best thing since sliced bread.

VOYAGER UPDATE - Dick and Jeana
First I would like to thank Burt for this opportunity to include in the RAF newsletter an update of the Voyager Around the World Flight Program. The project is still alive and well and progress is being made as fast as funds and resources will permit.

The last flight Voyager made was mid-November, 1984, at which time the Phase One flight testing was completed. Phase One was done with worn out junked engines and instrumentation we had readily available. Out of this we were able to evaluate the performance and handling qualities of the aircraft. The conclusion was that Voyager is capable of its designed goal . . . world unrefueled flight.

From the data acquired from the first phase of testing, we were able to select the world flight engines and avionics. King Radio is providing the avionics and Teledyne Continental Motors is providing the two engines. The front engine is a standard 0-240 air cooled (130 hp) and the rear engine is the newly developed IOL-200 liquid cooled (110 hp).

For the past year it seems little has been said about the project but as usual, if we're not talking, we're working! Our time has been tied up in test cell runs, wind tunnel evaluations, propeller acquisition/testing, putting together the avionics package, making new cowls, engine mount-hook up, aircrew life support systems (heat-vent-oxygen), the deployment planning and operational logistics. Things are coming together nicely. We expect to have Voyager flying before the end of the year and continue testing with the new engines, avionics and aircrew systems.

When are we going? I wish we knew! Voyager is a research and development (R&D) program that basically means there is more to it than first meets the eye and working towards a schedule is somewhat of a laugh. A very frustrating one at that. As it looks right now we will not be ready for a world flight attempt before the "weather window" closes toward the end of November. Although we should be flying, testing the new engine/avionics before that. At present we are looking at sometime next year before any attempt on the world flight can be made.

As you are all pretty much aware, Voyager has been funded mainly by individual contributions. It it hadn't been for this kind of support the project would have folded a long time ago. WE STILL NEED YOUR HELP!

Please let everyone know Voyager is alive and well. We have no intentions of giving up! There's a challenge to be met and with your help we will make it happen.

Thank you,
Dick Rutan and Jeana Yeager
Voyager Aircraft Inc.

Hangar 77 - Airport,
Mojave, CA 93501
(805)824-4790 or 824-4645

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

NO VARIEZE CHANGES

LONG-EZ PLANS CHANGES

LPC #122 MEO New canard plans, page B top right, third paragraph down. AN2-21A bolt should be AN4-21A. Also the 2 1/2" long spacer should be 1 3/4" long.

LPC #123 MEO New canard plans, page CI right corner of the page - the dimension 64" should be 65" and the dimension 10" should be 11". The elevator lengths shown are correct and should NOT be cut down.

LPC #124 MEO New canard plans, page C4 shows 7 x 14 x 64 foam block. Clarification: FB-1 should be 7" x 10" x 54", FB-2 should be 7" x 9 1/2" x 14" and FB-3 should be 4" x 7" x 54" - NOTE: Inboard cores

(with spar troughs 54" long) are cut out of FB-1. Outboard cores (no troughs) 11" long are cut from FB-2. Elevators are cut out of FB-3.

LPC #125 MEO New canard plans, page C4 calls out the length of the 3/16" stainless hinge pins, NC-8R as 36". This is correct. On page C, bottom right it is called out as 34", this is not correct but will work ok if you have already cut the material.

DEFIANT PLANS CHANGES
DPC 29 , MEO
Section I, page A-3 in the bill of materials, part #BRL-2 and BRL-3 are shown on page 34. This is not correct and should be 54.

DPC 30, MEO
Section I, page D-41, part NGB-18 flanged bushing. Two are required. These are called out in the bill of materials as steel machined parts. Should be oilite, Boston or bunting bronze bushings as shown on Page D-41.

DPC 31. MEO
Section I, bill of materials. Increase 4130N steel .050 thick from 6" x 6" to 6" x 12".

DPC 32, MEO
Section I, page D-44 center of page, Section A-A. AN509-10R12 (6 places) should be AN525-10R12 (6 places). Add 6 AN525-10R12 screws to bill of materials.

DPC 33. MEO
Section I, page D-32 - bill of materials calls out 52" of hinge material required to attach the ailerons to the wings. Since you must reverse this hinge stock, you will require at least 53" of MS20001 P6.

DPC 34, MEO
Section I, page D-40. The two screws AN509-10R14 required to mount RUD-8 are not called out in the bill of materials.

DPC 35, MEO
Section I, page D-48. The C-26 elevator push rod cannot be built as called out due to the AN4790HT16P not fitting inside a 1/2 x .035 wall aluminum tube. We suggest that a solid aluminum rod 1/2" in diameter be substituted for the 1/2" x .035" A. This solid rod should be 2024T3, should be approximately 4.5" long and will have to be drilled and tapped 1/4-28 into one end and 3/8-24 into the other end. You will need HM-4 and HM-6 rodends instead of the HF-4 and HF-6 called out. There are two C-26 assemblies required so you must double the above and change the bill of materials to suit. Add two AN316-6 jam nuts to the bill of materials.

DPC 36, MEO
Section I, page D-26, the elevator acuator tube (weldment) is correctly shown as C-27 should be C-20 (two places).

DPC 37,
Section I, page D-48. Small sketch of rear view of C-20 has notation at each end "shoulder of oilite bushing". Delete this notation, two places.

NO SOLITAIRE PLANS CHANGES

MAINTENANCE ITEMS
VariEze and Long-EZ engine mounts. Ray Cullen, VariEze builder/flyer reports a cracked engine mount. He says his wife noticed a change in the sound of the engine, so he returned to the airport. a subsequent careful inspection of the engine area revealed a crack 1/4" aft of the weld at the upper left attach point. Ray says he almost missed spotting it as it was hidden behind the brake arm. He and his mechanic had completed an annual inspection of this area just 20 hours previous to this, and both failed to find it. Evidently this crack had existed for some time and Ray suggests that the engine mount area should be closely examined on a regular basis.

This is the third known case of an EZ engine mount cracking. One was a Long-EZ (with unauthorized engine), the other also an 0-200 powered VariEze. All were conical mounts, we have never heard of a dynafocal mount cracking. We have carefully examined all of the RAF aircraft and even though they are all high time aircraft, we have found no signs of any cracks.

Inspect your mount regularly, especially the hard to see places around the welds near the firewall. If you notice a change in engine noise or a vibration, land and check the mount and the prop. Please report any findings to RAF.

BUILDER HINTS

Long-EZ builder Bill Friend sends in the following suggestions for insulating the brake lines at the wheel. Bill wrapped the exposed nylaflow (or nyloseal) brake line (from the trailing edge of the strut to the caliper) with fiberfrax (RTV silicone will help stick it down). The fiberfrax was then wrapped with aluminum foil. A length of heat shrink tubing was then slipped over the whole thing and shrunk into place (the heat

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shrink must be slipped on before the nut and ferrule are installed). We tried this system recently and it works great.

Lycoming Rocker Cover Gaskets - Mike now has approximately 120 hours of time on a set of four gray colored rocker cover gaskets, manufactured and sold by the REAL Gasket Corp. Doug Price designed, developed and is in the process of getting STCs for most Continental and Lycoming rocker cover gaskets. This is an area in our experience that has always been prone to minor, but annoying oil leaks. These silicone rubber gaskets have absolutely eliminated any sign of oil leaks. These gaskets are quite expensive, but if treated reasonably they are reusable. Doug Price has a supply of these gaskets that are not STC'd, that he is prepared to sell to homebuilders for $12.50 a set. (They normally sell for $8.91 each). These are the same as Mike used on his Long-EZ and the method he used to install them is as follows: Clean the two faces (rocker cover and cylinder head) until they are absolutely dry, with no oil on them. Install the gaskets dry (no

sealer of any kind), put a drop of Loctite on each screw and tighten the screw using a normal screw driver until they are good and tight - by hand, no torque wrenches. Do not retorque at all, leave them be and thy will last a long time and will not leak. Caution: DO NOT TIGHTEN THESE SCREWS IF THE ENGINE IS HOT.

for further information contact: The Real Gasket Corp.
P.O. Box 14852
Portland, OR 97214
(503)231-0341

Talk to Doug Price and tell him you are interested in his homebuilder special as discussed with Mike Melvill at RAF. Doug has gaskets for Lycoming 0-235, 0-320 as well as Continental C-75, C-85, C-90 and 0-200.

ROSENHAAN WHEELS, BRAKES AND AXLES

We have received very little feedback on the axle problem reported in CP 45. Those who have called have reported cracked axles, but no source to replace them. Ken Brock says he will set up and manufacture a run of these axles if there is enough demand. Please let RAF or Ken Brock know if you would like a pair and we will get with Ken on a specification. These axles should be machined from 4130N steel, with generous radii in all the corners.

The common problem of this type of brake rattling or chattering can be alleviated by installing a light spring vertically from the aft part of the Rosenhaan brake caliper up to the trailing edge of the gear leg. A glass tab on the gear leg will be required.

NOSE GEARS ON ALL EZs

Several builder/flyers have reported having the nose gear vibrate or jump out of the over center, down and locked position when landing hard, or on a rough runway. Should this happen, it will normally result in the gear retracting, allowing the airplane to come to rest on its nose. This will almost always result in the cast iron worm gear being stripped of its teeth. Keep in mind that this gear is never supposed to see any load greater than the retract or extend load. It will not support the airplane if the load gets into this gear. The design calls for the mechanism to crank the nose wheel down at which point the NG10A strut or shock strut takes all the load in compression and dumps this load through the NG50 weldment into the NG-14 spacer and AN4-41A bolt. See page 13-2 (Long-EZ, Section I). The worm and worm gear see zero load at this point.

If your airplane has shown signs of the nose gear handle trying to wind down on a rough runway, you need to check that your mechanism does indeed go over center and perhaps rig up some sort of a friction device at the instrument panel, behind the gear handle. If you are unfortunate enough to strip a gear, you can save the day, by turning the gear 180 degrees and using the other half. This trick only works once though.

LONG-EZ MAIN GEAR ATTACH

The AN6-80A bolt should be torqued to a value of 275 inch/lbs. Care should be used to assure that the nut does not bottom on the threads. If this occurs, it is possible for the loads to gradually cause this 3/8" bolt to elongate the holes in the aluminum extrusions. If you

bought your extrusions from Brock, you will note that they have flanged, steel bushings pressed into the aluminum angles, these steel bushings are available separately from Brock and are an excellent idea. If your AN6-80A bolt appears to be too long, simply add an extra washer or two under the head and under the nut to make certain that the nut is clamping down on the extrusion and LMGA tube. Of course, the general rule here is that you need two threads protruding beyond the nut.

The New Roncz 1145MS Canard - Hotwire templates A and B are supposed to be identical. A few builders have reported that Template B is slightly larger than Template A. We have checked a bunch of plans here at RAF and have found this to be true in a few cases. We believe this must be due to paper shrinkage or offset printing variation. In our checking we have found Template A to be more consistently correct and we advise you to use A as the master, clamp A and B together and file them both as a pair down to be identical to Template A.

Ralph Gaither, Safety Officer for the Navy and a high time VariEze pilot, reports what he considers to be a possible flight safety problem for pilots using a product call Thermeeze Tape (high strength ceramic tape). He purchased this product from Sport Flight in Florida. Ralph installed this tape per the instructions, to his exhaust pipes (this EZ already had over 800 hours of flight time). Within 100 hours the cowling was burned completely through in close proximity to the ceramic tape. In addition the tape crystallized broke down to a powder and generally fell apart into the cowl.

Ralph is very concerned that with this condition and the use of carburetor heat, some of the powdered ceramic tape could be ingested into the engine, possibly causing engine stoppage. In addition to this, Ralph noticed no benefit whatsoever to the operation of his engine.

RAF has never recommended this tape or any other similar material. If you are using it, we suggest an immediate, careful examination of the tape before next flight. Sport Flight has been informed of this problem.

DEFIANT BUILDER HINT

Virtually every Defiant builder to reach this stage has had problems fitting the canard between the forward firewall (F.S. 47) and the F.S.57 bulkhead, due to the structural buildup plies and individual tolerance build up. Rodie Rodewald ended up cutting his F.S. 57 bulkhead out completely and reinstalling it at F.S.57.3. He says this eliminated the problem. He also recommends building the forward canard attach tab (see Page D-26) so that it is about 1/2" longer than shown on this page (longer being towards the bottom of the page), then drilling the mounting hole through the F.S.47 firewall bulkhead at W.L. 47.9 instead of W.L.48.2 as shown. He says this made the whole job a snap, and talking to Johnny Murphy, he agrees. We have looked at his suggestion closely and believe it is a good one and recommend any builder who has not got this far to follow this suggested hint as outlined above.

DEFIANT PARTS WEIGHTS

While we have had Burt's N78RA down for re-engine modifications, we took the opportunity to weigh a few parts. These are presented purely as a reference, you should not necessarily throw your parts way if your are not exactly the same, but you should be somewhere close.

Main wing, winglet with aileron mounted, finished through white paint - 93 lbs.

Canard, no elevators, finished through white paint (includes NAV antenna) - 81 lbs.

One elevator with balance weight, finished through white paint - 8 1/2 lbs.

One aileron with hinges, no pushrod, finished through white paint - 8 lbs.

NON RECOMMENDED PROPS

We recently heard from an EZ builder pilot who was using a non RAF recommended prop and after only 22 hours of operation, upon noticing a new feeling or vibration, closely examined the prop and found compression failures in the wood about 8 to 10 inches out from the spinner on the forward face of both blades. Remember, most times you will get some type of warning before the prop really lets go. Pay attention. Any new noise or vibration should be investigated. We are becoming more and more advocates of the so called "multi-laminate" Canadian maple wood props. In our experience these props are stronger and allow more torque to be applied to the prop bolts without crushing the prop hub. We have routinely used 300 inch/lb of torque on the 3/8" prop bolts found on Lycoming O-235 and Continental O-200 with these props with no problems at all. Caution: Do not use more than 220 inch/lb of torque on the older style four or five laminations of birch type props. Also, remember to check the prop bolts quite frequently, particularly when the prop is new.

The following is an incident report from VariEze builder/pilot and Defiant builder, Emerson Grooters of Norway. It concerns the failure of a propeller and points up the importance of selecting a good reliable prop. If you want to experiment with untested or unusual props, do yourself a favor and follow the Formula one racing guys lead, install a safety cable on your engine. This is at least a 1/8" aircraft cable that ties the engine to the airframe. If you lose a prop blade, and don't get the engine shut down in time, the engine could come loose from the firewall.

"During testing of a new wood prop which I intended to use for some altitude and speed records, the prop failed with multiple fractures in the root area of both blades - forward face. The prop was not one recommended by RAF, however, I think that there may be a good point here for everyone - that is, just because you have a wooden prop don't think that it will automatically work with your aircraft/engine combination. I had 2.15 hours on the prop when I retorqued the bolts prior to an altitude test of the aircraft, my RR O-240 powered VariEze. I took off, climbed to 10,000 feet and checked various power/cruise

settings for about 25 minutes. I then climbed direct to 20,000 feet and started full throttle cruise test prior to further climb. At about 107 KIAS and 2700 rpm I noticed an increase in vibration from the engine. The vibration was not severe; however as it was a change from the norm, I cancelled my next planned step to 25,000 feet, reduced power to about 1/4 throttle and descended for landing. Total flight time 1.25 hours and total on the prop, 3.40 hours. On landing I saw the cracks in the prop. I was also glad that I had just had my chute inspected and repacked, even though I hadn't had to use it.

Last summer, my wife and I stopped to talk to another couple about their new beautifully executed homebuilt. They were both dead about 15 minutes later in a crash resulting from losing most of a prop blade. It was a one piece wooden prop recommended for their type aircraft - not a RAF type. I mention this because, just because you have a nice looking wood prop does not mean that you are home free. Also any change from the normal operating conditions of your aircraft should be fully investigated as soon as possible. A precautionary landing may be inconvenient and take a little time but it could save your aircraft and yourself.
Emerson Grooters"

FOR SALE
Lycoming O-235-C, 760 hours total time complete with accessories. $2300.00
Contact: Herb Peterson
327 Carol Road
New Lenox, IL 60451
815-485-8036

Continental O-200 zero since major. Sell outright or trade for Lycoming O-235.
Contact: Ben Buente
8250 Maple Lane
Evansville, IN 47711

Defiant Engines. Lycoming TIO-360-AIB turbochargers give sea level power to 15,000 feet. These are brand new engines, prefer to sell as a pair. $26,000.00 or $14,500.00 each
Contact: David Record
916-459-3533

Defiant or Viggen engine: Lycoming O-360-AID, disassembled with new valves, pistons, alternator and oil pump. Magnafluxed and yellow tagged jugs, carburetor, prop governor and 12 v starter. $6000.00. Also a few instruments available.
Contact: Bill Campbell
619-868-6218

Lycoming O-235-L2C as removed from a Cessna 152 (no damage). 1880 total time since new. Includes additional case for mechanical fuel pump. $2400.00.
Contact: Dan Mason
213-390-3444 - office
213-202-1882 - home

Long-EZ builder Jim Schultzman has come across a pure silicone rubber canopy seal, that is without a doubt the finest we have seen. It comes with its own adhesive, simply pull the protective tape and stick it down. It is a 'V' shaped extrusion that is normally part of a larger shape. Jim has set up a system to cut off the relevant 'V' shaped piece, so it can be used on an EZ canopy.

Contact: Jim Schultzman,
2638 Westwood Drive
Las Vegas, NV 89109

Antennas for composite aircraft. VOR/Localizer Glideslope antennas, marker beacon, comm and Loran antennas.

Contact: Antenna Dynamics Inc,
1251 W Sepulveda Blvd
Suite 268
Torrance, CA 90502
213-534-1090 Ext-22

Plans for forward mounted brake cylinders. This is the method pioneered over 8 years ago by the late Ed Hamlin and proven by many VariEze and Long-EZ builder/flyers. Debbie Iwatate (Long-EZ N455EZ) has written an excellent set of instructions on how to accomplish this. All she asks for a copy of this set of plans is a few dollars to pay for postage. We think it would be nice if people would send her $10.00 to cover printing, postage and handling plus a few bucks for the effort she has put out.

Contact: Debbie Iwatate,
400 South 41st Ave.
West Richland, WA 99352

Defiant nose gear - M20 Mooney 4 donut older style. $275.00

Contact: Lynn Burks
213-698-5441

Ian Ayton's gear/canopy warning device - as recommended by Mike and Sally. A really neat, small self contained unit which is easy to install, that causes the warning light to flash and the buzzer to buzz intermittently - makes it hard to ignore.

Contact: Ian Ayton
213-375-9269

WANTED

Help! Our VariEze project is stalled. We need someone to complete it for us for a share. 75 percent complete.

Contact: H.C. Alsop
145 South 2 East
Downey, ID 83234
208-897-5259 or 897-5314

SHOPPING

Herb Sanders recently sold his company 'Sport Flight' which is the recommended source for the VariEze O-200 exhaust system to John Queener, a Long-EZ builder. John will continue the name 'Sport Flight' and the new address is, 22267 Powell Road, Brooksville, FL 33512. The phone is 904-797-1874.

PRE-FABRICATED COMPOSITE PARTS

Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few

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customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS
Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING
From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE
For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS
We are pleased to announce three new products to our line.
1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. Winglets to follow soon at $799.00.
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.

Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415
(707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

LICENSE TO BUILD RAF AIRCRAFT
Those of you who are active builders know that your purchase of plans from RAF, entitles the holder to apply for a license to allow him to construct one aircraft from the purchased set of plans. Plans sold without the license indicate that the purchaser has obtained the plans for the purposes of using as a book or educational material to learn fabrication or design processes but not to build and airplane of this specific design.

In the past, RAF has accepted transfer of that license from the original purchaser to a second party when that transfer was requested by the licensee and the license was transferred. However since this summer, current agreements specify that RAF support only those who are previously licensed to build the RAF designs and we

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cannot issue further licenses for any further production of the designs. In order to provide the best possible service to those licensed to build the aircraft with the remaining funds available for support we must insist that the support be limited to only those who are legally building the aircraft. ie; those who have obtained a license to build one of the designs from RAF.

We are aware that there are instances where people are fabricating an EZ without a license from RAF. If those people have gotten information or authorization to do so from one of the licensees it must be made clear as to what the licensees' responsibilities are. Keeping in mind that the individual that has obtained a license to build a Long-EZ for example, has the permission of RAF to copy the prototype Long-EZ for one airframe. He is the aircraft manufacturer and he is using certain design information purchased from RAF as well as other design information that he has generated himself or obtained elsewhere. There

is no such thing as a conformal amateur built aircraft since there are no official conformality drawings accepted by the FAA or anyone. The FAA thus assumes that each aircraft is indeed a new type and does not have to conform to specific drawings or manufacturing processes. The drawings and manufacturing processes to be used on each airplane are totally the decision and right of the homebuilding manufacturer.

Now if you, as a licensee, wish to discontinue your project and sell it to someone, the new buyer is dealing with you, the licensed manufacturer, not with RAF.

RAF's responsibility is to support the individual that has the license, not a third party. Thus keep in mind that if you are selling a project, don't expect that RAF can or will provide builder support to the person buying your project. That responsibility rests with you the manufacturer. You are then effectively licensing the third party to produce an aircraft of which you own all manufacturing rights. It is strongly suggested that if you do sell a project, either a completed airplane or a partially built airplane or a set of plans, that your contact an attorney and have him draw up an agreement between yourself as manufacturer and the new party whom you are authorizing to build an airplane and be certain that the agreement provides you with some release or indemnification from liability should that aircraft ever be completed and flown. Keep in mind that you are ethically obligated and responsible to the person who has trusted you for that information and that he may need continuing support to allow him to operate the aircraft safely. If you own a license from RAF, RAF will provide the support to you, however, it is your responsibility to pass that on to the individual that you have your own agreement with.

Refer to the adjacent diagram. **DIAGRAM OMITTED** In order for us to provide adequate support to those that have the legal right from us to manufacture the design, we must deal only with the licensee. Keep in mind that if you sell your plans, you are not merely selling someone a library book. You are authorizing them to build an aircraft and warranting the information. You ethically should promise to them that you will follow up whatever support is needed in the future to allow them to safely operate any aircraft built from the design information you have sold them.

Many people do not realize the responsibility that may be attached to providing an agreement or license for someone to build a design based on information provided in the sale of plans. We do and that is why we intend to maintain our policy of providing to those licensed to build the aircraft any safety information that may come up in the future as a result of operational experience indicating any modification required or revision in the operating limitations.

This is why we at RAF intend to continue to provide the support necessary to allow a conscientious homebuilder to have the information at his disposal to build and operate a safe aircraft. The support role is not an easy task, it is one that involves many facets. Communication with the builder, continued testing of required modifications, follow up communication with the operators to determine if safety problems exist, accident investigation to determine if a cause is something that could be common to more than just the one aircraft, etc. The costs of maintaining all these activities have been

extremely high, thus we have had to seek out other jobs and activities for the personnel involved. We anticipate that the support will be limited to those items relating to safety of operation and to provide those licensed to build the aircraft.

Join EAA
Membership in the Experimental Aircraft Association Inc. is $30.00 for one year, $54.00 for 2 years and $84.00 for 3 years. All include 12 issues of Sport Aviation per year. Junior Membership (under 19 years of age) is available at $18.00 annually. Family Membership is available for an additional $10.00 annually.

Make checks payable to EAA. Address all letters to EAA.
WITTMAN AIRFIELD
OSHKOSH, WI 54903-2591
PHONE (414)426-4800
OFFICE HOURS: 8:30-5:00 MON - FRI

SURVEY OF ACTIVE BUILDER/FLYERS
RAF needs to determine those projects which are currently active since a large number of the early construction projects and the early aircraft are no longer active. This updated list will provide a more concise and correct accounting of those qualifying for builder support so that RAF can do the most through job possible providing support in the future. If you have been licensed to build a RAF homebuilt and your project is currently under construction or currently flying, it is imperative that you fill out the form and mail it to RAF. In this way we will have the information available to update your status and provide you with the necessary support without the dilution of many inactive projects. This form is not intended to provide for the transfer of license agreements between the licensee and others, only to update us with the status of the activity of your licensed project.

LICENSED MANUFACTURER/HOMEBUILDER DIAGRAM OMITTED

Note: The licensee, not RAF, is responsible to the new manufacturer. If you sell a completed aircraft, you may be liable for any manufacturing flaws. If you sell a partially completed aircraft, you may be liable for any flaws in your work. If you sell your project, or even just your plans, you are ethically responsible to provide builder support and to pass on safety information.

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SURVEY FORM OF ACTIVE BUILDER/FLYERS OMITTED

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Byrdell Mathew's Defiant project is really coming along. Byrdell is now working on engine mounts; essentially all composite structure is complete.

Charles Simms and his son with their Defiant project.

17 EZs flew in to Davenport, Iowa. Arnie Ash organized this get together and over 70 people flew/drove in.

David Haygard of Wichita, Kansas recently completed this excellent example. He calls it the "Wichita Express".

Emerson Grooter's set up for his Defiant spar cap.

Charlie Gray carving foam on his Defiant.

Shirley Brandt sent in this shot of her Long-EZ main gear attach. This is how it should look. Very nice work Shirley.

Larry Lombard, Michael Dilley and Jamie Ferretti, the folks at Lombard's. Long-EZ Kevlar cowling, both halves with stiffening ribs weigh 12.5 lbs.

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 47. If you are building from 2nd Edition plans you must have newsletters 18 through 47. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 47. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 47. If you are building a Long-EZ you must have newsletters from 24 through 47. If you are building a Solitaire, you must have newsletters from 37 through 47. If you are building a Defiant, you must have newsletters 41 through 47.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITIES
Since writing CP46 in October of 1985, we have been busy supporting our builders and working on completing the extensive job of installing the Lycoming 0-360, 180hp engines and Hoffmann 3-blade, constant speed, feathering propellers on Burt's prototype Defiant, N78RA. This job has taken much longer than we thought it would, mainly because of the fact that RAF is essentially active only two days a week, Tuesdays and Fridays and that the RAF people are now engaged in a very busy schedule working for Composite Prototypes, a division of Scaled Composites, Inc.

We are very happy to report that N78RA has now flown with the new engines and props. Unfortunately, we have not had time to complete a detailed flight test program before this CP goes to press, but initial impressions are quite favorable. Mike made the first flight and

reports that acceleration for take-off is impressive, and climb is dramatically improved. Level flight cruise is quiet and very smooth.

SOLITAIRE
The first homebuilt Solitaire has flown! Congratulations to Bob Matheny of San Diego, CA. Bob has over 5 hours of soaring time on his beautiful Solitaire named 14 BIS BIS, (see photo) and he says he is pleased with the handling qualities so far. He is very pleased with the Solitaire's crosswind landing capability, even in strong, gusty winds with heavy turbulence. GOOD SHOW, BOB! Your Solitaire looks gorgeous!

BUYER BEWARE
Any product that is marketed by another company that appears to copy the structure, aerodynamic design or systems of a RAF homebuilt, may not be the same as our prototypes and may not have been tested and proven to be safe. Just because an aircraft may resemble a RAF product, does not mean that it has our engineering blessing. We have developed, tested and provided appropriate safety related follow up only in the products that we have sold and authorized specific licenses to build.

WHICH DO YOU PREFER, GOING TO WORK OR BUILDING YOUR LONG-EZ????
If you answered the latter and are a good craftsman and work efficiently, we have an exciting job for you. Come to Mojave and challenge yourself while helping build some significant new research aircraft. We are in immediate need of two good bodies to work with Mike Melvill and Bruce Evans.

Immediate openings also for fabricators and also for a structure design engineer and a systems design engineer.
Contact: Mike Melvill at 805-824-2645 or 805-824-4541.

VARIEZE HOMEBUILT PROTOTYPE GOES TO THE SMITHSONIAN in Washington, DC
A request from Walter Boyne, curator of the National Air and Space Museum had us scrambling to prepare Burt's N4EZ for the long flight from Mojave to Washington. Doug Shane, a former RAF type, now working for Scaled Composites volunteered to fly her across the country on her last flight and has written an account of his trip. Thanks, Doug.

DOUG'S TRIP - MOJAVE TO WASHINGTON, DC
The first order of business was to get "4EZ" back in shape for flight. After its year-and-a-half of inactivity, a thorough check-up was in order. We decowled it and cleaned all of the screens oil and fuel), checked all of the linkages for freedom and safety, and replaced all of the Tygothane fuel lines, which had become very discolored (but still flexible) with time (they were 10 years old). We also felt that a cabin heat system of some sort might be appropriate (after all, it was December). The heater consisted of a piece of stainless steel cut from some scrapped muffler heater wrapped around the starboard exhaust stacks (similar to the carburetor air heater). A piece of red two-inch diameter Aeroduct was run from the muff to an aluminum tube which passed through the firewall just below the centersection spar, and joined a piece of 1.5 inch black Aeroduct which ran through the consoles and ended just short of the instrument panel bulkhead. The heat should have come forward into the footwell and at least helped keep my feet pink!

Once again airworthy, it was time to get the pilot proficient. I accumulated about five hours of flying, most of which was spent getting acquainted with cruise speeds, takeoffs and landings, cockpit organization (VariImportant), and airspeed system calibration. I also had the opportunity to "race" Bruce Evans' VariEze. Without wheel pants on 4EZ, Bruce had an estimated 5-6 knot advantage (he had wheel pants). With the pants on 4EZ, there was no measurable speed difference between the two airplanes. Put your pants on!

I packed the airplane the night before. Both main tanks were full of 24 gallons of 80-octane, and the header tank with its 2.5 gallons. The baggage was carefully organized. The flight planning was done. The weather promised to be exceptional. All there was to do was show up at the airport, push it outside, start it, and go.

Fortunately Bruce Evans was there, because as I tried to pull the airplane out of the hangar, I could not budge it. Flat tire! WaaaH! With Bruce leading, the cut tube was replaced and the airplane was ready to go within an hour.

VariEze N4EZ made its last takeoff from Mojave Airport into a crystal-clear sunrise and turned southeast. Bruce had decided to fly along, so we flew as a flight of two for about 15 minutes. There are few things as beautiful as the sunrise-light reflected from an airplane in flight: we flew along silently and enjoyed it. Then Bruce said "Adios" and peeled off to return to Mojave.

My first planned stop was Tucumcari, NM, about 750 nm down the road. As the flight progressed, it was obvious that Tucumcari was out of the question. The headwind gods were on duty, and I had to sacrifice sixteen knots to appease them. So Albuquerque was the next target. At ABQ, the sight gauges showed 1 gallon per side, plus the full header tank which I had relegated to VFR reserves. Santa Fe was an obvious point. When still on the mains at Santa Fe, Las Vegas, NM became the goal. I ended up switching to the header while entering the pattern, having never run the mains dry! The numbers went something like this: 672 nm airway distance in 5 hours and 5 minutes for an average groundspeed of 132 kt. The true airspeed at 11500 ft. was 148 kt. The first hour burned 6 gallons; the fuel flow for the cruise segments averaged 4.5 gph at full throttle. The total fuel burn was 23.5 gallons, which (with the headwind effects included) equates to 28.6 nmpg, or 32.9 statute mpg.

The next goal was Kansas City, but my hour-late departure dictated landing at Wichita (a.k.a. the Gateway to Nebraska, , according to P. Lert). 4EZ spent the night in the flight-test hangar at Beech Field. The next day I repositioned the airplane to Kansas City to sit out a cold front (and enjoy Mom's cooking).

A cold front in the Midwest in the winter makes a very bad situation worse, and this one was no exception. The surface temperature was +2 degrees F. with about an inch of fresh snow all over. Many thanks go to Brad Carter of Kansas City, who shared his hangar with 4EZ and

shielded it from the snow. Brad has an extremely well-built Long--a real jewel. Thanks, Brad! After a twenty-minute preheat (for the pilot as well), the Continental started on the second flip. Amazing!

I had several concerns taking off at KC. First was the snow. Although they had plowed most of the runway, there was still some packed snow covering about 60 percent of the surface. I was concerned about directional control, especially since I had a dragging left brake.

Second was the performance of the engine and systems in the airplane due to the cold. The third was my biggest concern--the canopy. I was afraid it would fog over after I closed it. So I requested a circling overhead departure, to let me evaluate the situation before leaving the pattern. Also, I left the canopy open until the last instant. The takeoff roll was started cautiously, all the while stabbing at the right brake. As soon as the rudders became effective, that concern was overcome. The canopy stayed clear because of (and what a miserable price to pay) the amazing number of cold air leaks in the cockpit.

So it was off to Washington. The first stop was at Louisville, KY, at Bowman Field. I was so miserably cold that I couldn't stand to go any farther. I was also still trying to appease the headwind gods, sacrificing about fifteen knots this trip. The leg required 17 gallons, with an average groundspeed of 132 kt. The cruise TAS was 150 kt at 9500 ft, full throttle. Fuel economy was worse because the mixture control was very stiff in the cold, making leaning difficult, and also because of the lower altitude and higher power settings.

(An interesting story about headwinds: While on a trip with John Roncz from New Orleans to Chicago, we stopped at the Jackson, TN Flight Service Station to check the weather ahead. John marched in and said in his usual loud, steady voice, "I'd like to order a tailwind!" The FSS-person looked him in the eye and with a perfectly straight face said, "We don't give tailwinds to YANKEES!")

I think the nice people at Kentucky Flying Service were taken somewhat aback at the monstrosity that climbed out of the funny little white plastic airplane. That's probably to be expected since I was wearing electric socks, wool socks, down socks, moon boots (a necessity), long underwear tops and bottoms, blue jeans, sweat pants, sweatshirt, flying suit, jacket, two pairs of gloves, and a wool cap over my David Clarks. Whew! And I was still cold!

After a short lunch and warm-up, it was off on the last flight of 4EZ. The trip to Hyde Field in Clinton, MD, was 427 nm at 145 kt TAS and (I could hardly believe it) a 10-knot tailwind! Upon arriving at Hyde, I made the requisite low approach down the east-west runway, and found a very bumpy ride and lots of surface wind which definitely indicated the north-south runway for landing.

The north-south was 1900 ft long, with a road at the south end (close enough so that you want to bounce the mains off the car roofs as you flare) and powerlines and trees at the north. Careful approach speed management was called for here, and I planted the mains on the numbers at about 65 kt. No problem at all, and with moderate braking, we were stopped by midfield.

It took several minutes before I could pull the mixture control to idle cutoff and end the flying career of such a wonderful airplane. It certainly had its glory; its lines and performance caught the eye of thousands of people, and its siblings have brought thousands of hours of joy to their builders. I developed quite a warm spot in my heart over the 25 or so hours I flew it, and my Long project screams at me even more loudly now to finish it.

The next morning, four craftsmen from the Smithsonian's Silver Hill facility met me at the airport to transport 4EZ to their shop. We had the airplane disassembled and loaded on a trailer within half an hour, and drove the pieces into suburban Maryland. The Eze was parked in a holding area of the display section of the facility next to a Kreider-Reisner biplane, an equally beautiful airplane in its day.

The people of the Silver Hill shop are warm, friendly, interested, and enthusiastic, and welcomed the chance to show what they were working on and what they had completed. To a person, all are true craftsmen who are doing the work they are because they love it and truly care about the significance of the airplanes they tend and restore. Do not go to only the downtown National Air and Space Museum and miss going to Silver Hill!

Many thanks to Mike and Sally for helping me prepare for this trip with work and encouragement, and to Burt for the opportunity and the fine, fine traveling machine, the VariEze.

Oh, by the way, on the return trip, the cabin heat system in the DC-9/MD-80 worked extremely well!

DOUG SHANE

ARE HOMEBUILTS SAFE?

FAA accident statistics show that per hour flown, a homebuilt is at least three times more dangerous than its general aviation store bought certificated counterpart. We have studied the accident records of these aircraft and have found some specific information that highlights the reasons for this large difference. The reasons are these general categories.

1. Low Flying/Buzzing/Aerobatics

This cause results in a relatively small percentage of accidents for the Cessna, Cherokees etc. We are astounded to see that the vast majority of serious homebuilt accidents fall into this category (3 out of 4 Long-EZ fatal accidents, 7 out of 11 total

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accidents/incidents). It seems that the homebuilts are such fun to fly that the pilots take risks that they generally do not take when flying their Cessna 172.

2. Engine/Prop Failure

Engine failures on homebuilts occur much more often than factory-builts, basically because many homebuilders do not apply adequate workmanship in the engine installation. A homebuilder who is not an A and P should get one to inspect his work and better yet, have an FAA

designated IA approve the installation as would be required for a certified aircraft.

Note that the 2 categories described are items that you as a homebuilder pilot have complete control of if you fly your aircraft as you would your Cessna and inspect and maintain your power plant as you would your Cessna. Your exposure to the risks of an accident should be as good or probably better than that for the general aviation average. It is a shame that while we see many cases of a homebuilder being spared because he was in a homebuilt (safer stall characteristics and longer glide after engine failure), we still, due to things under his control, find him in a much riskier environment.

DEFIANT NEWS
On January 23, 1986, Defiant N78RA lifted off runway 30 at Mojave and was once again in her element, this time with O-360, 180hp engines and Hoffmann 3-blade, constant speed, feathering props on each end. The weather was far from ideal, but we were not testing a new airframe (aerodynamically) so we decided to go for it. Acceleration was very brisk and initial climb was conducted at reduced power. Once we were above the turbulence level, above 9000 msl, we began to appreciate the smooth, quiet operation of these beautiful props. With the RPM's pulled back to 2300, power at 18" manifold pressure, it was very quiet and the airspeed indicator showed that we were really zipping along.

Unfortunately, the props were not yet fully "tweaked" and we were unable to evaluate any meaningful performance, but it was quite obvious that the performance is improved. We have vernier-type prop controls installed (rather than the lever type) and we are very pleased with the smooth and accurate control possible. Fidelity is excellent and with the Hoffmann type prop we feel this is important. The wood/fiberglass composite blades have comparatively low mass and low inertia and therefore pitch changes occur very rapidly.

With either prop feathered, engine stopped, the Defiant climbs well even at 10,000 msl, but with the aft prop windmilling, (fine pitch) engine at idle, the front engine even at full throttle was unable to do better than 500 ft./min. rate of sink! Obviously, with constant speed props, it will be mandatory to be able to feather the props in case of an in-flight engine problem. Perhaps the most impressive improvement over the fixed pitch props was the excellent sink rate on short final with power at idle or near idle. The blades go flat and act as powerful drag brakes, and the Defiant develops a rate of sink which should greatly improve your ability to fly a comfortable approach into a short field or a field with obstacles.

We have not installed an electronic "synch" control. We have found it very easy to synchronize both props. You can set the same indicated RPM or do it by ear and get the same RPM. Here the vernier prop controls are really nice. At this point we see no reason to install an expensive electric or auto-synch mechanism.

Installing the Hoffmann props has not really been difficult. The problems we have run into, have all been due to our inexperience with constant speed props and prop governors. The small adjustments to prop governors, to low pitch prop stops, etc., that must be done to optimize

an installation have been frustrating and time consuming due to our lack of familiarity with these kinds of things.

Hoffmann of Germany has been very helpful and very patient with us during this time. In retrospect, we would have been time and money ahead to have expert assistance in this area and we would strongly recommend that you have an experienced prop installer help with the installation. In our case, a lot of our problems centered around the fact that we had two completely different engine models, one of which had never had a constant speed prop installed and required considerable work to bring it up to the correct condition.

Identical engine types such as O-360-A1A or whatever, set up to operate constant speed props would have made the job much easier. If you contemplate ever installing constant speed props, be certain that the engines you decide on are capable of operating constant speed props! As an example, an O-360-A4A cannot even be converted to constant speed operation!

Work on the Defiant engine installation plans has been at a standstill due to the available manpower being exclusively devoted to getting N78RA back in the air. As soon as she is back in routine flying order, we will give priority to the engine plans. These plans will consist of 14 or 15 large sheets (same as section 1), but due to the cost of producing such a low volume run of pages this large, these pages will be blue printed from the originals. Accompanying these large pages will be a booklet similar to Section II of the EZ plans, an 11"x17" booklet with words, sketches and lots of photos of both Fred's and Burt's engine installations. We have not come up with a price at this time, nor are we certain when it will be ready to ship, but we will definitely be making these plans available.

The Defiant owners manual is available now and covers all the weight and balance and performance information normally found in an owners manual. These can be obtained from RAF for $15.00 which includes postage and handling (California residents, please include 6 percent state tax).

As far as we know, only four Defiants are flying so far, Burt's, Fred's, Johnny Murphy's and Dr. Frank Yost's. We have not heard of any new ones but there are several that are getting close. Rodie Rodewald from Hawaii, Dr. George Best of Phoenix, AZ., and Charlie Gray of Kissimmee, FL., are all in the finishing stages. (All three of these builders have Hoffmann props in hand!) We routinely hear from perhaps as many as 10 builders who are well along, with essentially all structure done, then there are probably a dozen who contact us occasionally who are building but not too far along. The only really active Defiant group we know of is the Texas Defiant Group. Charles Sims, 1918 Atlanta, Deer Park, Texas, 77536, 713-476-5406 (home), puts out a regular newsletter containing info from the group's builders. Anyone interested, contact Charles Sims and send him a letter with your status and hints. A group like this can be tremendously beneficial to all those in it since any mistakes made by the first builder to get there are eliminated for those who follow. If you work alone and isolated, you have to make all the mistakes and then suffer the frustrations and extra time required to fix them.

An example of the kind of problem that can be aggravating is the fitting of the canard between the aft face of the front firewall and the forward face of the F.S. 57 bulkhead. A number of builders have come to grief here and, really, there is no reason to. You should have your canard built, including the lift tabs before you build the fuselage. This means, obviously, that you can measure the distance from the forward face to the leading edge attach tabs to the aft face of the aft lift tabs. Now, look carefully at Page D-26 and D-25, and you will see that you will have to add to this dimension the thickness of the flanges on the CS-11 flanged bushings (.032x2), plus the thickness of two CS-8 aluminum plates (.063x2). Don't forget the thickness of the CS-8 aluminum plates on the leading edge attach tabs (.032").

Probably the best approach here is to add all these dimensions together for your canard. This may be exactly per plans but is much more likely to be large enough to cause you to move the F.S. 57 bulkhead aft of F.S.57 by as much as 1/4" or even 3/8".

If you have already fallen into this trap, the best way out is simply to cut the F.S.57 bulkhead out, throw it away and build a new one. Using a small disk sander (such as a 4" diameter Makita) carefully sand some of the 3 plies of BID off the fuselage sides, forward and

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aft of the F.S.57 bulkhead. Don't try to sand all of it off due to the danger of damaging the inside skin. Don't sand off any of the 8 plies of BID extending aft for 8" from the front firewall at F.S.47 to F.S.55 (see page D-34, top right). Do sand dull from F.S.55 forward about 3" to F.S.52 to allow a 1" per ply overlap of the 3 repair plys of BID that will be required when you install your new F.S.57 bulkhead in the correct position to allow your canard to fit perfectly. Don't forget that these 3 plies of BID lap onto the forward face of the F.S.57 bulkhead which adds 3x.012" of material thickness which will encroach on the space between these two bulkheads where your canard has to fit.

This whole thing sounds quite complicated, but in fact, it is quite simple if you sit down, take your time and study the problem. To sum up, all you have to do is position the F.S.57 bulkhead aft far enough to allow your canard with all attach hardware to fit snugly between the front firewall F.S.47 and bulkhead F.S.57. Simple, HUH?!

Very preliminary performance evaluation of Burt's Defiant with the constant speed, feathering props showed the following:

ALT.	OAT.	RPM (frt. & rear)	MAN. PRESS. (frt. & rear)	IAS (kt)	TAS (kt)	TAS (mph)
9000	9 degrees C	2300	23"	163	189	217
9000	10 degrees C	2100	23"	157	182	209
8700	12 degrees C	2550	23"	168	195	224

Defiant
Now that we have flown our Defiant, N78RA, with constant speed, feathering props, we are surprised at the comparative complexity that

this change has added to what was such a simple airplane. We consider the constant speed, feathering Defiant to be a more dangerous airplane that the prototype we have flown for the last eight years for the following reasons.

The need to identify and feather the failed or failing engine, considerably increases pilot work load and increases the the chance that he will make mistakes. The higher drag at idle, while useful, increases the chance of misjudging the landing flare when power is being manipulated. This could result in a high sink rate touchdown if the pilot gets behind the airplane. For these reasons and with consideration that many Defiant pilots will be marginal experienced multi-engine pilots, we estimate the accident rate may be considerably higher on the constant speed feathering aircraft that it will be on our original, simple, fixed pitch airplane.

Our strong recommendation is that the minimum experience requirement with a Defiant with constant speed, feathering props, be excellent, current proficiency in a standard light twin such as a Duchess, Baron, or Cessna 310. The discussion in the Defiant Owner's Manual relative to the pilot proficiency requirements, does NOT apply to a Defiant with constant speed, feathering props.

DEFIANT NOSE GEAR

The Defiant nose gear is a Mooney nose gear unit. Mooney has put out a service bulletin (M20-202) which speaks of steering/tracking improvements. We have essentially reiterated that bulletin below.

1) Level the aircraft and center the nose wheel.

2) Hang a plumb line over and forward of the nose gear trunion (see sketch).

3) Measure forward from the aft edge of the plumb line to the axle centerline. This distance should not exceed 0.6", or be less than zero.

4) If you have more than 0.6" or less than zero, you will have to add or subtract spacers above the suspension donuts (see sketch), until your axle centerline is within this tolerance. **SKETCH OMITTED**

This drawing shows the motion of the Defiant nose gear retraction mechanism. A number of Defiant builders have had difficulty visualizing just exactly how this works. Actually, it is very simple. The NG-2 arm must be swung through an arc of about 190 degrees. The central pivot of this arc is at W.L.37 and F.S.64.5. To do this, the gear handle moves up and forward, then swings back and down, see below. The NG-4 finger operated lever operates the gear down lock NG-6 and also the gear up lock, NG-7. Hopefully this will clarify this area for any builders still having a mental block! **SKETCH OMITTED**

"LOMBARD'S" UPDATE

Larry Lombard and Michael Dilley have been turning out EZ cowlings and shipping them as fast as the orders come in. EZ cowlings have always been a bit of a "beast" to install. It seems that they never fit quite right. Michael is building a Long-EZ and he studied the problem. He came up with the theory that the aft rib was stiffening the cowl halves so much torsionally that the cowling could not be forced to fit the shape of your airplane. As a result, the job of installing a cowling has developed rather a bad reputation.

The decision has been made to ship cowlings with the aft rib not installed. The best method is to completely install the cowling, then flox the prefab rib into the upper and lower cowl. After it cures, lay up one ply of BID at 45 degrees over the whole rib, lapping onto the cowling 1" all around.

Using this method, the cowling is much easier to install and you get a nice fitting cowling into the bargain. All cowlings shipped by Lombard's since January 1, 1986, have been and will be, shipped with the aft rib loose and you will install it yourself per the above.

Larry was down here at RAF taking all the measurements on Burt's Defiant necessary to enable to them to build cowlings that will fit a homebuilt Defiant using any combination of 150hp, 160hp, or 180hp engines with either fixed pitch wood props or constant speed feathering props such as the Hoffmann propellers installed on Burt's Defiant. Due to the almost infinite possibilities of engine/mount/prop extension/prop and spinner, the chances of building one cowling (especially the front cowling) to fair perfectly from the spinner to the firewall are essentially zero. Therefore, Larry and Michael will be supplying the front cowling about 4 to 6 inches short of the spinner. The builder will mount his or her engine/mount/prop extension/prop and spinner, then the cowling will be jigged and mounted. The spinner and prop will be protected with gray tape. Foam blocks will be cut and fitted between the cowl and spinner and carved to a perfect faired fit. Four plies of BID will be layed up to lap onto the cowl. After cure, the cowl will be split, the foam cleaned out and one ply of BID will be layed up on the inside of the cowls to tie things together and, presto! you have a perfect fit, no matter what combination of prop, extension and spinner you may have. The rear cowl does not have the same design constraints and will be shipped ready to install. The only change that may be necessary, depending on your particular engine/prop/spinner combination, would be to trim the trailing edge or shorten the cowling to match to your spinner.

Larry and Michael are also working on a pair of low-drag main wheel pants for the Defiant. These will probably look like something between Burt's prototype and Fred's Defiant.

Last, but not least, Larry and Michael have formed their small company into a corporation. As of now, this corporation will be known as FEATHERLITE PRODUCTS, INC., P.O. BOX 781, 13451 AIRPORT ROAD, BOONVILLE, CA 95415. Be sure to write or call for a quote and compare prices and quality with any of the bootlegger outfits. Keep in mind that Larry and Michael are the only RAF approved and recommended manufacturers of prefab glass parts for all of the RAF designs.

INSURANCE FOR EZ'S

This is a subject we at RAF have not addressed before. We believed it was up to each individual. Lately, however, we have been receiving and inordinate number of requests and inquiries. We have done a little investigation into the insurance situation and what we have found is not very good news.

From what we can learn, very few insurance companies will even cover experimental aircraft, particularly composite aircraft. One insurance agent told us that part of the problems have been caused by a very high accident rate of two other composite canard designs (not RAF airplanes). Most of these accidents were takeoff or landing accidents that resulted in considerable damage to the aircraft involved. Many of these aircraft had full hull coverage and the builders involved put is claims out of all sensible proportion to what it would have realistically cost them to do the repair. The result of this, predictably, has been an unprecedented increase in insurance premiums and, in a lot of cases, it has become very difficult to even obtain insurance. Several major companies now refuse to insure composite homebuilts. Unfortunately, all composites have been lumped together, so those of us who fly EZ's are being penalized even though the EZ's have an excellent safety record.

Many of us who have been flying EZ's for several years now have been shocked by insurance premiums that have doubled or more. We at RAF have been insured through the EAA recommended insurance company, Aviation Insurance, P.O. Box 19267, Greensboro, NC 27419, for a number of years, yet this year, our premiums have almost doubled. We have heard from several builder/flyers who have received quotes of between $500.00 and $800.00 a year for liability coverage only! Our approach to this problem has been to request a quotation for liability insurance to cover only the pilot and aircraft and not the passenger. This has dramatically reduced the quoted premium to between $250.00 and $300.00 per year depending on pilot experience and time in type.

Full comprehensive or hull coverage on an airplane which you have built yourself is probably a waste of money. Full hull insurance is very expensive. Most companies have a deductible of $500-$1000.00. Most accidents that would result in damage to the aircraft requiring an insurance claim probably would be taxiing accidents, brake failure, 'run into the hanger' type accidents. The kind of thing that might require a new canard or wing, at most. Think about that - you built the original, obviously you can build a new one and, probably, at less cost than the deductible!

Some builders have difficulty obtaining even liability insurance coverage for first-flight and first 40 hours of testing. The insurance companies' reasons for this is that the pilot has zero time in type. This leaves our first time builder/pilot with no insurance coverage. This is an added mental burden that the new pilot does not need at a time like this. What other choice does he have? Get a check out in a Long-EZ or VariEze? Who will let him fly their pride and joy from the front seat? Very, very few builder/pilots will do that. No, he has no choice. He goes ahead, he flys his first flight, flys off his 40 hours. Now, he can get liability insurance coverage, because, now he has time in type - ironic, it is not?

If you have any questions, contact Harry Hannish at the EAA headquarters, (414)426-4800. Harry may be able to help.

This editorial is printed here not to offer solutions, we know of no solutions. It is published in the hope that it will result in some input from you, the reader. If you have any experience, suggestion, or solutions, we would like to hear from you. Write to the Canard Pusher at RAF.

FUEL FLOW INDICATORS

We have used several different brands of fuel flow measuring devices, and obviously for flight testing, they are essential. After flying with on of these gadgets installed and operating for awhile, we have found them to be very valuable, even for simple flight planning on a cross country. For a long time we used an automotive type "compucruise" with an aircraft grade Flo-scan transducer. This worked quite well, when it worked. In 4 years (600 hours) we replaced the electronic "guts" three times. Our main complaint we the flashing display and erratic indication. That is to say the gallons per hour was not stable, the tenths of a gallon continuously ran up and down several tenths. We also tested a 'Fuelguard' fuel flow/fuel used indicator, but it was much worse in the erratic display department and we could not recommend this instrument. Recently, we installed an Alcor fuel flow with the time and fuel

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remaining feature. At last, we have an accurate and extremely stable indication of fuel condition. By far the best we have used, the presentation is very good, a clear, large LCD screen shows fuel flow in gph on the left and gallons used on the right. A flip of a switch lets you read time remaining at present power setting on the left, and fuel remaining on the right. You can enter the fuel load very easily using one momentary switch. Back lighting is automatic and comes on as it gets dark. You can dim it as required with a built-in dimmer. The flow transducer is a Flow scan, and is a good one. Each transducer is individually calibrated to the electronic microprocessor and best of all, you can calibrate the instrument yourself to give extremely accurate information over a particular range of flow. You can also set the instrument to read in gallons, lbs./hour or imperial gallons/hour. The instrument is very light and quite small.

We are really happy with our Alcor and heartily recommend it to anyone who would like this kind of information available to them in flight.

FIRE EXTINGUISHERS IN THE COCKPIT

There are now many small Halon fire extinguishers available at very reasonable prices. Halon is the only fire extinguisher that can be used in the case of a fire in the small confines of a cockpit. While electrical fires are not all that common, they do occasionally occur and if one ever happens to you, particularly in flight, without a means to extinguish the fire, you have little chance. A classic example of how a small fire extinguisher can save the day occurred to us here at RAF. We were taxi testing an airplane when a brake line failed and the brake fluid ignited. It was a small fire, but it quite rapidly began to burn the paint on the wheel pant and the paint on the gear leg. If

we had not had one of these small fire extinguishers available, we would probably have had to sit by and watch it burn. We were over a mile from the nearest building at the other end of the airport!

Small, easy to mount Halon fire extinguishers are available from many aircraft supply companies including Sporty's Pilot Shop in Cincinnati, Ohio. Don't let it happen to you, order one now and mount it in your cockpit where you can easily reach for it anytime. It is very cheap insurance.

OXYGEN AND COLD FEET
Mike and Sally have been doing quite a lot of high altitude, cross country flying in the last 6 months and they have purchased a portable oxygen system. It is an "Aerox" high duration system that uses "oxysaver" (TM) nasal cannulas instead of the usual face mask. They are very pleased with this system. It is comfortable to wear, allows normal conversation and, best of all, the 22 cu.ft. aluminum oxygen bottle (4 1/2" diameter x 29" long) will allow two people to remain at 17,500' for up to 11 1/2 hours!! The bottle fits into the left strake baggage area where it is convenient for the pilot to observe the pressure gauge. The nasal cannulas are so comfortable that after a few minutes, you forget you have them on! You can also eat or drink with no problem. Try that with a face mask!

Using oxygen allows an EZ pilot to take more advantage of tailwinds at altitude, which can result in very cold feet! Outside air temperatures of -10 degrees C are quite common, even in the summer. Mike and Sally recently tried wearing "moon" boots, the common "after-ski" boots available at most K-Marts, etc. for $15.00-$20.00. A pair of wool socks inside a pair of moon boots will allow you to cruise at OATs of -10 degrees C for 2 or 3 hours, without heat, and without any discomfort. TRY 'EM. you'll like 'em!

Contact: Ken Johnson
Aerox Aviation Oxygen Systems, Inc.
P.O. Box 5343
Hilton Head, SC 29928
1-800-237-6702

ACCIDENTS/INCIDENTS
A California based Long-EZ landed over 100 feet to the right of the runway centerline. Touchdown occurred off the runway, one mainwheel almost two feet lower than the other down a burm. The airplane hit hard and flipped over, sliding to a stop upside down. There were strong gusty crosswinds at the time, so much so, that an experienced A-36 Bonanza pilot aborted his landing attempt and went to another airport. The pilot suffered neck injuries and the passenger had minor injuries.

This accident was definitely avoidable. You should never commit to land if you cannot comfortably hold the airplane on the extended runway centerline. Go around, go somewhere else, nothing should be important enough to loose your airplane.

An Alabama VariEze took off after a thorough preflight with full tanks. At 400-500 feet AGL, the engine quit with no warning. All attempts to restart failed. The choices for a landing site were bleak, trees or a

small road. This pilot chose the road and lowered his nose gear. Just as he was really committed, a truck came over the rise. Trees and utility poles would not allow him to move over far enough, so his left wing hit the truck and broke off. The VariEze was pretty much totally destroyed, although the cockpit remained enough intact that the pilot got out with only a broken leg.

The accident investigators found a mud dauber (wasp-like insect) had built a nest 6" up the fuel tank vent line where it was very difficult to find, even with a thorough preflight. The FAA investigator recommended a screen over the fuel tank vent.

We believe a screen over the vent would reduce the necessary ram pressure to near static pressure. Our recommendation would be redundant vents. Put another 'T' in the vent such as downstream of the top 'T' and run a second vent. Be sure and check both vents for obstructions every 100 hours.

This letter from Rob Cook, VariEze builder, is printed in its entirety. Hopefully, it will prevent anyone else from making the same mistake. Rob was doing a high speed taxi run with the canard installed, but with his main wings still in his garage! NEVER attempt a high speed taxi run unless you are mentally and physically and mechanically prepared to fly.

"Dear Mike,
First, thank you for your help and understanding. Feel free to publish the following account of my accident any way you see fit.

If you don't believe that the little canard on the front end of your VariEze produces all that much lift, listen to this! I've been taxi testing my VariEze for about two months. At the Concord, California airport it's easier to taxi to the other side to see friends, get advise, etc. than it is to drive around on the surface streets. I've taxied at indicated speeds up to 60 mph and found the airplane easy to handle throughout the speed range. These tests were done with and without the canard installed. The main wings are in the final finishing stage and the airplane has only been taxied once with them on.

On August 16, at 6:30 pm I lined up on 19 right and pushed the throttle to the firewall. The acceleration was brisk to say the least! I was indicating 60 mph in about three hundred feet. I pulled the throttle back half way and made sure I wasn't still accelerating. Everything was stable. I eased back on the stick and the nose came up slowly. The airplane was rolling straight but the nose kept coming higher. Pushing the stick forward resulted in no gain except in angle of attack. The throttle was off by now.

I remember thinking "Why am I going through this? I'm going to end up in the grass and be really embarrassed!" I was pressing full force on the brakes but to no avail. At 15 degrees angle of attack the prop started to contact the ground. I could hear it. The resulting torque transfer to the ground caused the airplane to start turning sharply to the left. I saw the tower and at the same time heard them dispatch the fire truck.

By now I was just along for the ride. The tires couldn't resist the turn and the airplane flipped. I remember seeing the tower roll inverted. The first thing to hit was the left wheel. The gear had enough spring to throw me into one more roll, this time landing inverted. The canopy shattered, the headrest collapsed

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forward, and the slide began. Thank God I didn't have my seatbelt on! I was conscious for the whole hundred foot ride. When everything stopped, I turned off the master and mag switches and started talking to myself. Just wanted to be sure that I stayed awake!

I was laying upside down on the back of my neck and bleeding pretty good. The fire truck was there immediately and I was pulled out and taken to the hospital. Three hours of surgery and six days in the hospital is mighty expensive learning. It took two more hours and two more days to have me back to being pretty again!!

Well, it has been three months and I'm back full time on the airplane again. It's in much better shape than I was. It's going to need a new canopy. right upper wing attach fitting, prop (the old one will make a nice sixteen inch clock), and what the hell, I knew I'd end up with the Long-EZ gear in the long run anyway. Oh, I almost forgot, the canard snapped five inches outboard of the spar on the under surface. It's already repaired and looks as good as new.

The FAA, bless their hearts, didn't call it an accident ... no intent to fly. Even though this has been written in a light vein, I think the message is pretty loud and clear. THINK, and after you've given an idea a thorough brainstorming, try it out on someone whose judgement you trust. And then .... be careful. The only reason I can give for still being alive is that it just wasn't my turn.
Sincerely,
Rob Cook"

RAF DESIGN CLUBS AND GROUPS

International VariEze Hospitality Club
Don and Bernadette Shupe
2531 College Lane
La Verna, CA 91750
714-593-1197

This one is a must for all EZ pilots/builders and their spouses. A super newsletter four times a year and super flyins and flyouts several times a year - only $10.00 for US and Canada and $12.00 for overseas.

Long-EZ Squadron I
Russell Harris
13211 Chestnut Street,
Westminster, CA 92683

Strictly for Long-EZ builders, you must own plans and possess a RAF serial number. Excellent newsletter 4 times a year, $12.00 a year.

Long-EZ Squadron II
David Orr
1451 Berwick St.
Los Angeles, CA 90049

Similar to Squadron I, in fact a spin-off as a result of too many members. Both of these groups have a very high rate of completed airplanes.

Dayton DUCKS - (Dayton United Canard Klub!)
7313 Dabel Court
Dayton, OH 45490
513-435-0882

The "DUCKS" have been in operation for several years and have a substantial list of members building and flying EZs.

EZ Builders of Florida
Charlie Gray
2314 St Croix
Kissimmee, FL 32741
305-847-7070

Open to EZs, Defiants and most other composite designs. Good newsletter and flyins.

Central States Association,
Arnie Ash
Rural Route #5,
Davenport, IO 52806
319-386-5245

Open to all RAF designs. A new organization - good newsletter.

Atlantic Coast EZ Squadron (ACES)
O.N. Pete Petree,
RT 6 Box 99-B
Laurinburg, NC 28352
919-276-7186

A new organization to exchange ideas, for all EZ types.

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of

recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

PLANS CHANGES

NO VARIEZE CHANGES

LONG-EZ PLANS CHANGES

LPC #126, MAN
Vortilons on the leading edges of each main wing are mandatory - see this CP, Page 15.

NO DEFIANT CHANGES

SOLITAIRE PLANS CHANGES

SPC #58
Section 1, page A-20 The wheel forks are attached to the SLG-9 tube (rear) and the SLG-3 tube (front) by drilling a #12 hole aligned along the butt line, through the casting and the steel tube. An appropriate AN3 bolt and MS21042-3 nut are then installed.

SPC #59
Engine installation plans. Note: Hydraulic jack oil should be used in the electro-hydraulic engine extension system. Do not use brake fluid. Hydraulic jack oil is obtainable from any auto parts store.

NOTE: Please report any plans errors that you find to RAF so that we can keep all of the builders as up-to-date as possible.

BUILDER HINTS

LONG-EZ R1145MS CANARD UPDATE
IMPORTANT for all builders of the R1145MS canard: If you bought NC-CLT aluminum lift tabs from Ken Brock. These are the "retrofit" lift tabs

and should have been used only by builders planning on replacing an existing, already mounted canard. For some unknown reason, a few builders building this canard as new construction have managed to use this lift tab. It is best recognized by the fact that it was blank at the attach point. It did have 3 holes at the top, exactly as the original CLT lift tab did, but it does not have a hole at the lower, rounded end. If you have used the CLT original lift tab which did have a pilot hole drilled in the rounded end, you are OK. If you have used the blank lift tab from Brock, Part #NC_CLT, it must be replaced. DO NOT FLY WITH THIS LIFT TAB. This tab was incorrectly manufactured from 2024-0 aluminum which is dead soft. The correct material is 2024-T3 aluminum which is heat treated and much harder, with a much higher bearing load capability.

Ken Brock has mailed out registered letters to all known purchasers of part #NC-CLT warning of the incorrect material and offering to replace them with the correct material. Do not ignore this situation, even if you have installed them and are ready to fly, ground the airplane until they have been removed and replaced.

This is really not such a traumatic job as it appears! We have done it ourselves several times. Using a Dremel saw, carefully cut through the bottom skin in front of each lift tab (don't try to cut through the spar cap!!). Remove a skin patch approximately 2" wide by 1 3/4" forward of and centered about each lift tab. (See sketch). **SKETCH OMITTED**

Now dig out enough foam to be able to see the heads of the three AN-4 bolts that anchor the NC-CLT lift tabs to the shear web. Using a dull chisel or even a screw driver and a small hammer, chip away enough micro so that you can fit a 7/16" box-end wrench on each bolt head. Remove these bolts and give the lift tabs a sharp tap forward and they will pop off. Send them back to Brock in exchange for the "real" ones. Sand the aft face of the new lift tabs with 320 grit and sand the face of the shear web. Smear a thin layer of flox onto the shear web and re-install the three AN-4 bolts. Carve a block of blue foam to fit as closely as possible into each of the holes and micro them into place. (Pour-in-place X-40 can also be used). Sand the foam to match the bottom contour, and carefully sand the bottom skin completely dull a minimum of 3" each side of each hole and about 1" forward of each hole. Layup 3 plies of UND spanwise. Across the repair area, the largest ply goes on first. Since most, if not all of this repair is inside the fuselage very little fairing is necessary. Do not be intimidated by this repair, it is quite easy and can be done in a surprisingly short time.

We have received several more reports from builders who have completed and flown the R1145MS canard and without exception, all have reported no rain trim change. One builder, though, has reported a "flat spot" or area of low response when he pushes the nose down (elevator trailing edge up). He has adequate nose down authority, but has to push forward more than what he feels is normal for good nose down response. We have looked at his canard quite carefully and have not found any obvious difference.

We have noticed a slightly "softer" nose down response when compared directly with the original GU canard, but no "flat spot" or area of

almost no response. We would appreciate hearing from all builders who are flying the new canard. Please report your opinion of the flying qualities, control authority, and rotation speed differences, any stall speed difference, and of course behaviour in the rain. Comparisons with your original canard would be useful, too.

When you build your R1145MS canard, areas to be as accurate as possible with that are sometimes ignored, are the shape of the canard "cove" or trailing edge and the elevator leading edge. These two define the "slot" shape, which is quite critical and should be given your best attention. The lower half of the leading edge of the elevator should be a section of a circle, and smooth. There should be no spanwise bumps or ridges. (See sketch). **SKETCH OMITTED**

ELEVATOR SHAPE
We have had this in many CPs in the past, but surprisingly, we still find builders out there with the bottoms of their elevators convex or curved. No matter which canard you have, you must have perfectly flat bottoms on your elevators. Lay a machinists 6" scale or other known straight edge chordwise across the elevator bottom. There should be contact from the tangent point of the elevator torque tube to the trailing edge as shown in the correct example below. **SKETCH OMITTED**

If your elevators are not flat or look like the INCORRECT example, you elevator will try to float trailing edge down in flight. As a result you will find yourself pushing forward on the stick at cruise speed, and probably will not have enough trim authority to trim off this force. This is normal at very high speeds, but should not be true at cruise speeds.

R1145MS CANARD
Several builders have reported not being able to get the full 15 degrees of elevator trailing edge up travel. This is very important to assure adequate nose down authority at aft limit CG. The best way to assure that this does not happen to you is to follow the plans as far as jigging the elevators into position with the NC-3 hinges inserted into the slots in the canard. Do not pour in the wet flox yet! Using scraps of wood stirring sticks (tongue depressors) and Hot Stuff glue, temporarily tack each NC-3 to the canard bottom skin as shown. **SKETCH OMITTED**

Use Hot Shot to kick the Hot Stuff off. (If you don't have a bottle of the thick Hot Stuff and Hot Shot, you really are missing a very handy jigging tool). You should now have the NC-3 elevator hinges temporarily bonded into position, with the elevators mounted to

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them. Carefully break off the elevator jigs "L". This should let you swing the elevators on their pivot pins. Using an angle finder (Sears or Pro-line) check the full available elevator travel. If you find you are unable to get the full 15 degrees of elevator trailing edge up-travel, break the Hot Stuff glue joints, and repeat the procedure, this time shimming the "L" jigs off the canard bottom skin with pieces of tongue depressors. This will move the elevators down relative to the

canard, allowing more travel in the trailing edge up direction (nose down command). Once you have a full 15 degrees or even 16 degrees to allow for finish, re-bondo the "L" jigs to the canard and elevators. Break off the Hot Stuff-ed scraps and pour in the wet flox to lock the NC-3s in place. Do not pour in flox into these slots until you are absolutely confident that you have the full 15 degrees of travel. Removing these NC-3s after the flox cures is virtually impossible.

WELDMENTS FOR THE R1145MS CANARD

Paul Green from Ken Brock Mfg. would like all builders of the new R1145MS canard to know that when Brock made the first run of NC-12A weldments (pitch control belhorn in elevators), the #12 drilled hole called out in the plans, was inadvertently drilled as a #2 hole (almost 1/4" instead of 3/16"). Brock has available a small steel bushing, part #NC12B which can be pressed into this oversize hole and will then give you the correct size #12 hole.

The NC-13 bushing called out on page C-2 is now available from Ken Brock Mfg. Due to a mixup when Paul Green talked to Mike Melvill, Brock has been shipping CS-13 bushings, which are not quite long enough. Several builders have run into this problem, it causes the pivot point at the NC-12A weldments to be too tight. Contact Brock (Paul) for the correct length part #NC-13.

Judge King, Long-EZ N350JK has just completed his new R1145MS canard, which he retro-fitted to his Long-EZ. He has an easy way to transfer the existing 1/4" diameter holes in the F-22 bulkhead to the aft face of the new undrilled NC-CLT aluminum lift tabs.

1. Fit your new canard per plans, be sure the water line is level with the top longeron level (correct incidence).
2. Remove the canard and paint a thin film of oil around the hole in the F-22 bulkhead. Spray a coat of any color paint on top of this oil film about 2" diameter around the 1/4" holes.
3. Obtain some foam tape with stick on both sides (1/8" thick 3M double stick foam tape works great). Stick this on the aft face of the NC-CLT lift tab centered roughly over the area where the hole will be.
4. Install the canard and clamp the NC-CLT lift tabs firmly against the F-22. Remove the canard. The paint will now be on the sticky surface of the foam tape and a perfect impression of the 1/4" diameter hole will be clearly visible.
5. Now make a drill guide out of 1 1/2" x 1 1/2" piece of 1/8" aluminum scrap. Drill a 1/4" diameter hole through it. Lay it on the foam tape, exactly centering the guide hole over the paint impression location of the hole. Clamp this drill guide to the NC-CLT using two small 'C' clamps.
6. Drill through the drill guide, through the foam tape and through the NC-CLT, both left and right and presto! You have a perfectly matched canard to F-22 bulkhead.

VORTILONS FOR LONG-EZs

Due to the wide variety of workmanship, flying characteristics can vary considerably from one airplane to another, even though they may have been built from the same plans. We have been confident up until now that Long-EZs were pretty much immune from a main wing stall, if they were operated within the normal limitation of gross weight and CG. Recently we were surprised to learn of a stock Long-EZ that experienced

a main wing stall. Admittedly this aircraft had been loaded to well over normal gross weight, but the fact that it occurred at all has led us to make the following change a mandatory one for all Long-EZs, regardless of which canard is installed.

All Long-EZs must have three vortilons installed as shown on the leading edge of each main wing. We have conducted rather extensive testing of vortilons and they definitely do add to the stall margin of a swept wing.

They have always been required when using the new R1145MS canard, they are now required even if you have the original GU canard installed.

Probably the best way to install vortilons is to make them with a small flange on each side. Finish them through final paint (using your trim color is a neat idea) then glue them to the finished wing in the appropriate position using a small amount of clear RTV silicone.

We have included full scale patterns for each vortilon, as well as a plan view and front view showing the positions at which each vortilon should be installed. The main design requirements are that the vortilons are mounted so that they are vertical, relative to the aircraft in level flight, and that they are mounted parallel to B.L.O. or centerline. They do not cant outboard or inboard. The vortilon itself should be made from a six ply BID solid glass layup. The flanges can be two plies of BID on each side of each vortilon.

BUILDER HINTS
Lycoming oil dip stick to long? Well, you can buy a shorter one or you can cut it down yourself. First you must determine how much shorter yours needs to be. For a Long-EZ, a VariEze or even a Defiant, you will probably need to shorten it around 3". Use a pin punch to drive the retaining pin out of the yellow dip stick screw-on cap. Pull the dip stick out of this cap. Cut 3" off the cap end of the dip stick (or whatever dimension will work for you), note that the end that was inserted into the cap is machined down to approximately 3/16 (.1875). This will have to be done to your new shorter dip stick and will require the use of a lathe. Press the dip stick back into the cap, drill a #40 size hole through the dip stick using the cap as a drill guide, and drive the old pin back into place. Peen the cap to prevent the retaining pin from vibrating out. Now, using the short (3") piece of dip stick as a guide, cut the proper length out of the middle of the plastic dip stick tube using a fine tooth hacksaw. **SKETCH OMITTED**

Use Hot-Stuff instant glue (or similar Crazy Glue, etc.) to join the two pieces together. Hot Shot or Zip Kicker makes this job easy. Now sand at least two inches each side of the joint very thoroughly with 40 grit sand paper. Cut a piece of BID glass 4" x 16", wet it out with epoxy then wrap it around the plastic tube, centered over the joint. Roll the tube using all 16" of BID. Now wrap peel ply over the wet glass layup and pull it tight. Allow this to cure, remove the peel ply and paint it black with high temp spray paint. Screw the tube back into the engine and safety the lower end. Screw in the dip stick and you are done. We have used this method on all of the Lycoming powered airplanes we have built here at RAF over the past 10 years with no problems at all.

MAIN GEAR ATTACH ON EZS
Every 100 hours or once per year, you should check your main gear attachment points for any movement. The best way to do this is to lift the wheels, one at a time, clear of the ground, supporting the wing on a piece of foam to spread the load. Get into the rear cockpit and put your hand on the attach point. Have a friend push and pull the wheel in a fore and aft motion. You should not feel any movement at the attach point. If you feel movement, you may have a problem developing. If there is significant movement, you will have to go in and see what it is. It probably will be the bolt holes in the aluminum extrusions, elongating and allowing the bolt to move. This is much more likely to occur in a VariEze than a Long-EZ. Best repair is to ream the holes out to a larger size, press in a steel bushing and bolt the gear back in place.

VARIEZES WITH THE ORIGINAL ROSENHAAN AXLES
We requested that anyone who would want us to try to get Brock to manufacture a set of steel axles to replace the aluminum ones that have been cracking, to contact us. To our surprise everyone, without exception who contacted us did find cracks in the axles. Yet we only received three requests for Brock to manufacture replacements. The results?

No axles will be made. You are on your own. We suggest you take your best existing axle to a local machine shop and have them make you an identical set from solid 4130N steel. We recommend a more generous radius between the flange and the axle, at least a 3/8" radius would be good and would not interfere with anything. NOTE: Three builders have found an AN4 axle attach bolt broken!! Check your axles and attach bolts soon. The other option is to trade up to Cleveland 500 x 5 wheel and brakes. We have heard from a number of VariEze pilots who have done this.

DELAMINATIONS
Repairing small areas of delaminated skin, can best be done by drilling several small holes around the effected area and injecting epoxy into one or all these holes until it comes out of the rest of the holes. Cover the area with Saran wrap, a flat board and a heavy weight. Allow to cure. One of the problems with this type of repair is finding a hypodermic syringe. Try this: go to a sporting goods store, buy a cheap plastic repair kit for a leaking basketball.

Drain the tube of glue, wash it out thoroughly with water, dry it and fill it with epoxy. Make your repair and throw it away. Works great. Best way to check for a suspected delamination is to tap the area with a quarter. You will hear a solid clear ringing sound if it is a good layup, but as you cross over a delaminated area, it will sound hollow.

MORE THOUGHTS ON COOLING
Cooling is a rather controversial subject, certainly one that has caused more consternation than most. We have done a lot of testing recently using several different VariEzes and Long-EZs.

This is a brief summary of what we found: If you only have one CHT probe, install it on the most forward cylinder, cylinder #4 on a Lycoming, cylinder #1 on a Continental. In a normal EZ per plans engine installation, the forward two cylinders will invariably run hotter than the aft two. We have consistently found the most forward cylinder running as much as 100 degrees F hotter than the most aft cylinder.

If you have a four probe CHT system, one you can rely on, that has been calibrated and is known to be accurate, you can experiment with "ramps" on the floor of the lower cowl, as shown in CP42, page 3. The deflector ramps will dramatically change the cooling pattern of your engine, depending on the shape, size and position of these ramps. It would be difficult and maybe even foolhardy to try this without good instrumentation.

The way the cooling in an EZ cowl works is apparently not the way it works in a Cessna 150. For example, in an EZ, ram (male) scoop or NACA flush scoop, the high velocity cooling air enters the cowl and most of this air runs up the slope of the lower cowl, hits the aft vertical baffle, and squirts up through the fins of the two aft cylinders.

Since most of the incoming air has gone, at high speed, through the aft two cylinders, in most cases overcooling these two cylinders, the forward two cylinders do not get enough cooling air, so it follows that they run too hot. This is the way it is, at least, on the several EZs we have closely examined.

If you accept the above scenario, it follows that a ramp or several ramps installed on the lower cowl, positioned and shaped to deflect the high-speed, incoming, cooling air cause it to go up and through the forward two cylinders, should do the trick. In all cases we have tested, we have been able to reverse the hottest and coldest cylinders! This is pretty significant and what it tells you is that with some experimenting, you can get all four cylinders running within just a few degrees of each other. Everyone who has seriously tried this has reported the same results. This has included some real skeptics.

In the last two weeks, we have tested 6 EZs, two VariEzes and 4 Long-EZs, using a water manometer. We used a stock Cessna 150 as a kind of "baseline". We found that a standard ram inlet EZ compares very closely to an EZ equipped with a flush NACA inlet, provided both have well-built, close fitting baffling and both have the same size, stock cooling outlet. Changing the size of the outlet will change the pressure drop across the cylinders.

Of course, there is a lot more to cooling than the pressure drop across the cylinders. "Blockage", or the resistance to the flow of cooling air caused by the baffled engine is a big driver. Very poor baffling or no baffling at all, obviously will result in a very low pressure drop. Very tight baffling forcing the incoming high pressure air to slow way down will obviously result in a large pressure drop. This differential is called the delta'p' and is measured in inches of water.

Lycoming says that for a Lycoming 0-235 engine, you need a delta 'p' of about 4" of water. The curves shown below are the results of our recent tests. **CHART OMITTED**

Note that the two Long-EZs with the lowest delta 'p' across the cylinders (only 3" delta 'p' at 160), do in fact, have good cooling. Both are well equipped with 4 probe calibrated CHT gauges. What does this prove? Only that if the baffling is excellent, tight with absolutely no leaks, the cylinders will cool acceptably even with only 3" of water delta 'p', also, note that both of these Longs have smaller than normal cooling air outlets.

The temperatures on the above airplanes are measured at the bayonet cylinder head fitting on the Lycomings and on the top spark plugs on the Continentals. One of the Lycoming engines is really well instrumented, with probes on all four cylinders at the bayonet fittings, and on the bottom spark plugs as well as on the top spark plugs. The results of this test are as follows: Maximum power setting (mixture slightly rich for the climb) results in the bayonet probes averaging 360 - 380 degrees F. Bottom spark plugs average 400 - 420 degrees F. Top spark plugs average 440 - 460 degrees F. At 10,000 feet, OAT = +10 degrees, in level flight at maximum continuous power, (mixture leaned to best power max. EGT), the bayonet probes average 330 - 350 degrees F. The bottom plugs average 360 - 380 degrees F and the top plugs average 430 - 450 degrees F. In spite of an average difference of 70 - 100 degrees F from the bottom to the top of each cylinder, this is probably about as good as you can do and is quite acceptable, according to Lycoming.

The optimum baffling for an EZ engine is probably not possible due to the mechanical difficulty of building it, but you can come close. For a Lycoming 0-235 or Continental 0-200, try to baffles as close to the sketch below as you can (NEXT PAGE)

SKETCH OMITTED

OIL TEMPERATURE PROBLEMS

Dick Rutan has been doing a lot of cooling related testing on the Voyager and during his test for optimum oil cooling, he discovered an interesting method to improve cooling air flow through an oil cooler. Using the Voyager water manometer, Dick found that with an oil cooler mounted on the inside of a cowling, such as a Long-EZ does, where the cooler is in the high pressure plenum of the cowl, and vented to the free stream, the following delta 'p' measurements were true.

With NO reverse scoop over the oil cooler (you can see the cooler from outside) the pressure differential was 1.8" of water. He installed a reverse scoop per plans, still 1.8" of water delta 'p'. He moved the reverse scoop forward, exposing half of the oil cooler - 3" of water delta 'p'! A dramatic improvement to say the least. Next he moved it forward enough to expose the whole of the oil cooler - 3.8" of water delta 'P', and much cooler oil temperatures. If you are having oil temperature problems in your EZ, try this neat trick. **SKETCHES OMITTED**

We would like to thank Dick and the Voyager program for this very helpful hint and also for his help and use of his instrumentation for the previous article on engine cooling.

VARIEZE O-200 OIL TEMPERATURES
Most VariEzes powered by the O-200 Continental engines, by all reports, have oil temperatures that, if anything, run on the cold side. However, every once in a while we hear from a builder/flyer with high oil temperature problems!

This has been a puzzle and no one has resolved it 'til now. How could some EZs run cold and others run hot? The answer may be in the oil temperature gauge. If you use a Westach or Westberg oil temperature gauge and you have had low oil temperatures, (maybe you have even wrapped the oil tank with an insulating cover?). Check your oil temperature by some independent means, a different gauge or even a candy thermometer. At the very least, you should calibrate your gauge against a known value.

Our experience here at RAF has been that in 3 different VariEzes using Westberg gauges, showing low oil temps all 3, in fact, have high oil temperatures. One had such high oil temps, the oil pressure would run at the minimum value of 30 psi!

The key is that if ever you see low oil pressure, check your oil temperature even if your gauge says it is OK. This is particularly true if you are using the Westach or Westberg temperature gauges which in our experience over a number of years, have proven to be erratic and without frequent calibration, not to be relied on.

CAUTION - BRAKE FAILURE
We have used NYLON NYLAFLOW brake lines in all of the RAF designs so far with very low required maintenance. There are a few points that require care and if you do sloppy work here, you may set yourself up for a potential brake failure. If this occurs after a period of hard braking, it is even possible to have a brake fire. This could have serious consequences, so do not take this lightly.

First of all, NYLON lines must never be stored where they get exposed to direct sunlight. An excellent idea would be to store your roll of brake line in a black plastic bag until you are ready to install it. After it is installed, paint it with black or silver paint. Do not roll it out into the sunlight without wheel pants or paint to protect it. Heat can soften the Nylaflow and allow it to expand under pressure, and possibly even burst if the heat is excessive. For this reason, it is very important to route the brake lines as far as possible from the brake disc. Keep in mind that under heavy breaking the disc can get very, very hot. This heat radiates toward the gear leg, (which must be insulated with several layers of fiberfrax siliconed to the strut) and if the brake line passes between the strut and the disc, you have set yourself up for a potential disaster. The brake line must pass inboard of the strut, which keeps the strut between the disc and the brake line. In addition we strongly recommend insulating the brake line with fiberfrax. We cut a long narrow strip, perhaps 5/8" wide, applied silicone to the fiberfrax and wound it around and around the brake line until it was covered from where it appeared out of the trailing edge of the strut to the nut on the

fitting on the caliper. A little tape will hold it in place, slip a piece of heat shrink tubing over the whole thing and shrink it down onto the fiberfrax. We also wrap this in aluminum foil, which of course helps by reflecting any radiated heat.

If you have not taken any of the above measures and have been operating your airplane for any length of time, the chances are that you may already have caused heat damage to the nylon line. Repeated heat applications to a sample piece of Nylaflow have shown that it causes imbrittlement. It becomes stiff and when you try to bend it, it may break. If you have this problem you should replace the brake lines. This is not as hard as it may sound. We have done it a few times ourselves. Use a dremel with a small saw, 3/8" - 1/2" diameter, cut through the glass into the brake line at the trailing edge, full length from fuselage to wheel. Grab one end of the brake line and pull it out through the saw cut. Install a new piece by opening the saw cut and carefully working it in full length of each gear leg. Layup a thin ply of hobby store glass or one ply of BID to retain it in the trailing edge of the gear and you have it. The whole operation can be done in an hour! **SKETCH OMITTED**

CP47, Page 11

We have recently installed "Nyloseal" nylon tubing in two of our aircraft for brake lines and, so far, it looks very good. We only have a few hundred hours of test time at this point, but we are pleased with its performance. All of the above precautions were, of course observed. One of the best ideas to avoid heat problems associated with heavy breaking, is to cut vent holes in the highest point in the wheel pants (aircraft parked nose down). This allows trapped hot air to rise out of the wheel pant, drawing in cold air to cool the hot disc.

For new construction, a good suggestion would be to install a hardware store type plastic tube into the trailing edge, such that the brake lines may be slipped through for easy removal if it should ever become necessary. You would need to find a plastic tube with about a 3/16" to 1/4" I.D. The stiff type of hardware store plastic tube would be best.

CAUTION: CONTROL SYSTEM STIFFNESS

We have previously warned builders to ensure absolute freedom from stiffness in the pitch control system. This is very important and must be corrected if it exists in your EZ. We never have particularly addressed lateral (roll) control system stiffness. While not quite as important as pitch, tight bearings in the aileron control system really spoils the nice flying qualities inherent in an EZ. Conscientious attention to detail here will pay dividends. Long-EZs and VariEzes have similar lateral control systems, the main difference being that the CS-132L belhorn in a Long-EZ is mounted inside of the wing root, and the same part (CS-132) in a VariEze hangs out in the breeze, inboard of the wing root, close to the bottom cowling.

Both of these areas can be troublesome. In the Long-EZ, you must assure that the end of CS-132L cannot contact the bottom of the wing. Even if you have to dish the skin locally, you cannot accept any rubbing here. In fact, it would be best to have at least 1/4" of clearance. The VariEze though, needs even more clearance between the

lower end of CS-132 belhorn and the bottom cowling, because the cowling will tend to flex up in flight and could cause a rubbing interference, or even worse. For example, if your CS-132 belhorn just barely clears the bottom cowl while at rest on the ground, it is possible that in flight the cowl could move up enough to seriously interfere with lateral control of the aircraft! The answer is a streamlined blister on the bottom cowl which will give the required clearance and will stiffen the bottom cowl.

Lubricate all bushings and bearings in the control system and do not fly until you have the control system working nice and free with no tight spots or stiffness anywhere within the full range of control stick movement.

CAUTION
Long-EZ electric fuel boost pump. Be sure to use the proper pump with a maximum of 6 to 8 psi. A float type carburetor cannot handle the high pressure pumps found on fuel injected engines. A 15 to 28 psi pump will flood a normal carbureted engine and shut it down. This has already caused one Long-EZ to land short of the runway! The small square shaped 'facet' electric pumps sold by Wicks, Aircraft Spruce and Brock are all fine and are set to limit below 6 psi.

CAUTION
Breather hose must be clear! This is critical, do not allow the breather hose to kink or fold onto itself. Keep all curves as smooth as possible and for bends use the largest radius possible. Do not neglect to insert a "stretched" spring into the breather hose per CP31, page 4. This will help to eliminate any tendency for the hose to "fold" or kink when it is hot. The "stretched" spring consists of 5/8" O.D. screen door type spring (hardware store quality), which you will stretch until it yields and takes a set with the coils about 1/2" apart.

If your breather hose kinks or becomes clogged in some way, the build up of pressure inside the crankcase will blow the main seal (behind the prop) out and will rapidly pump most, if not all of your oil overboard. Oil temperature will rise and the engine will seize if you continue to fly. Even at idle, the engine might seize!

PROP DAMAGE
Pusher aircraft are probably more prone to prop damage generally speaking, than tractor aircraft. As the builder/pilot and mechanic on your own EZ, you should be aware of this and should pay particular attention when you have been working on the engine, or inside the cowling. Leaving a small wrench on top of the engine can really ruin your day! When it comes out, it will really do a number on your prop. Before buttoning up the cowl, always do a very careful inspection for loose washers, nuts, bolts, even clipped ends of safety wire. All should be removed before starting the engine. Be sure not to leave a wrench or nuts or bolts on the wings or centersection/strake area - (don't laugh, it happens.) Unless you have a spare prop, the result can be a 6 to 8 week period of waiting for a new prop!

One other thing, if you see damage to your prop, a small gouge or nick, do not assume that it was thrown up by the gear. It may have been, but in our experience if there is a gash in the prop, it almost certainly

was caused by something coming out of the cowl. A screw, camloc, washer, whatever. Remove the cowl and carefully inspect the whole engine. Look for missing rocker cover screws or exhaust nuts. Almost without exception, when this has happened to us, we have found a place where something came loose. Be very conscientious about cleanup and tidiness in your engine compartment. Be sure and use new lock washers every time you remove the exhaust system. Check your rocker cover screws for tightness, and safety wire any bolt or screw that you have any doubts about. Above all, don't be careless about laying tools on top of the engine. Be careful and you will get excellent utility and life out of your props.

"PLANE" EFFICIENCY
We recently received a summary of the results of all 6 CAFE events, plus several of the LBF and DULLES air races. All have been sorted and computed using the CAFE formulas (speed) to the power of 1.25 x (MPG) x (payload) to the power of .75 and are arranged in order starting with the highest CAFE score. The results are most interesting. The highest ever CAFE score was achieved by Dick Rutan in his own Long-EZ. Dick loaded his airplane with 3 people(!) and proved, once and for all, that when it comes down to which aircraft can carry the most payload at the highest speed using the least amount of fuel (which is after all what efficiency means, doesn't it?), the Long-EZ can't be beaten. Second highest CAFE score was put up by Gary Hertzler's incredible little 80hp VariEze, followed by Gene Sheehan's Q-200.

We have not seen these results printed anywhere else and we thought you might be interested.

SUN 60 RACE at the 1986 Sun-N-Fun flyin on Wednesday, March 19th 1986. This is an all out speed race of approximately 60 miles. Originally conceived as a race for Rutan EZs, the Sun 60 Race this year will be open to experimental homebuilt aircraft of any horsepower, with a class for Rutan designed aircraft and a class for Glasairs. There is no handicap, you simply race against the clock. Entries are limited to 35 aircraft, the entry fee is $10.00 and trophies will be awarded. For more information and an entry blank, send a self addressed, stamped envelope or call:

Charlie Gray,
2314 Saint Croix St.
Kissimmee, FL 32741
305-847-7070

FLY-IN 1986
What promises to be a super fun flyin is being organized by Long-EZ builder/flyer, Buzz Talbot, 222 Sunshine Drive, Bolingbrook, IL 60439. 312-759-1124. This EZ autumn adventure will be over the Columbus day weekend of October 10-13, 1986, at the Rough River Dam State Resort in Falls of Rough, Kentucky.

Should be great. Contact Buzz for more details.

SHOPPING AT RAF

The following items are available from RAF. Of course, all the additional plans (meaning engine installation, owner's manuals, speed brake etc) are also available.

Moldless Composite Construction Book	14.50
VHS and Beta Tapes	
Moldless Construction	59.95*
Weight and Balance	59.95*
Both tapes bought as set	99.95*
*Plus $4.00 postage	
Gold and Silver VariEze and Long-EZ tie tacs	6.50
Books:	
The Complete Guide to Rutan Aircraft by Don & Julia Downie	13.95
Canard - a Revolution if Flight by Andy Lennon	17.95
T-Shirts:	
Blue - Long-EZ logo with "Laughter silvered wings" - small, medium, large, Xlarge	8.00
White Polo shirts - Long-EZ logo with "RAF"	14.00
Caps - blue with white front and any aircraft patch of your choice	7.00
Patches-VariEze, Long-EZ, Defiant, Solitaire	3.00
Rutan Aircraft patch	3.00
Aircraft name patches	1.50
Some assorted belt buckles, mainly VariEze and Defiant and Solitaire	25.00
Posters:	
Long-EZ two ship	2.00
Defiant on Water	8.00
3-ship Defiant, VariEze and VariViggen	2.75
8 x 10 color Long-EZ	1.25
8 x 10 color Defiant	1.25

SHOPPING

Audio/visual warning system similar to that used and recommended by Mike Melvill in his Long-EZ, N26MS. This device gives a warning of a battery charge malfunction, low oil pressure, canopy unlocked or gear up by attracting the pilots attention to a flashing light and a loud buzzer. Pressing a defeat button will silence the buzzer for approximately one minute.

Control unit is .64" x 3.25" and is panel-mounted. Comes complete with oil pressure sender, three micro switches, gear-and-canopy-warning buzzer and simple installation manual. $139.50 (CA residents add $8.37 tax). Ian Ayton. Ayton and Co., 4061 Via Pavion, Palos Verdes Estates, CA 90274. 213-375-9269.

Escort 110 Nav/Comm. Like new condition. Includes mounting tray, plug and installation and repair manual. This radio has a built-in intercom system. $385.00 complete

NACA cabin vent doors, bi-directional, light weight. Will fit VariEzes and Long-EZs. EZ to install. $6.50 each.

Light weight nose wheel fenders for all EZ's. Constructed of fiberglass and aluminum. Ready to paint and install. $37.50

Contact: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406

ATTENTION DEFIANT PLANS OWNERS
KEN BROCK MFG. reports that they now have over two-thirds of all the Defiant prefab metal parts on the shelf, ready to ship, with more parts being completed every day. Only 50 sets of these parts have been produced. If you have a set of Defiant plans or contemplate ever building one, don't wait, with only 50 sets of parts they may not be there if you delay too long.

ATTENTION SOLITAIRE PLANS OWNERS
KEN BROCK MFG. now reports that they have 100 sets of all the prefab metal parts required to complete a Solitaire. BROCK will be offering these parts for a limited time only at discount prices. If you contemplate building your Solitaire, do not delay, these parts must be moved. They need the shelf space. Contact: Ken Brock Mfg., 11852 Western Ave., Stanton, CA 90680 714-898-4366.

Rusty Foster has a new, improved design for his well-known "Space Saver" panel. This panel is pre-wired and includes 20 circuits. All switches (rocker type) are rated at 20 amps - 14 volts, and the appropriate circuit breakers are installed and wired. A wiring diagram suitable for a Long-EZ or VariEze is included.
Contact: Rusty Foster (Foster's Modular Design Co.)
PO Box 1569
Portola, CA 96122

Debbie Iwatate (Long-EZ builder/flyer) has updated and improved her forward mounted brake plans to include several cosmetic and functional changes that she incorporated into her beautiful Long-EZ. She has put this collection of neat ideas into one very attractive booklet which she has available for $20.00. Debbie has done a super job on this little book.
Contact: Debbie Iwatate
400 South 41st Ave.
West Richland, WA 99352

PR-88 Barrier Cream is still the best we have ever tried. We use it every day at RAF and a can goes an amazingly long way. Available from WICKS AIRCRAFT and AIRCRAFT SPRUCE.

Aircraft Spruce also has Ian Ayton's audio/visual warning system and pre-moulded NACA air scoops for sale.

FOR SALE
Lycoming O-235-L2C 118hp. 190 hours since new. Complete with all accessories including a 6" prop extension, B&T prop, and spinner. For Long-EZ. $5000.00. (Engine only - $4700.00)
Contact: George Kelley
213-596-3051

Lycoming O-235-C1. 80 hours since major overhaul. Includes starter, generator, and carburetor. Make offer.
Contact: Guy Selman
113 Earl Hall Ave.

San Ysidro, CA 92073
619-428-4211

Brand new Great American prop for 100 hp VariEze.
Contact: David Robertson
513-231-7122

Rolls Royce O-200, 100 hp engines (Continental O-200 built in England by Rolls Royce). Two complete engines presently disassembled, will sell as is or will assemble.
Contact: Paul Martin
Ottawa Muni Airport,
Ottawa, KS 66067
913-242-5310

Vernon Voelzke would like to contact nearby Defiant builders.
Contact: Vernon Voelzke
105 Gilley Ave S.
Brookings, SD 57006
605-692-2813 - Home
605-692-6145 - Office

Bob Matheny - First homebuilt Solitaire to fly! **PHOTO OMITTED**

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Burt Rutan taxies out for his last flight in his favorite airplane - N4EZ. His words upon landing, "Best airplane this company ever built!!"

Four beautiful instrument panels to wet your appetites!

Mark and Brenda Rogers - locals here at Mojave after Mark's successful first flight - they recently were transferred to Lubbock, Texas - the Long-EZ performed flawlessly on its first cross country.

This one says it all - Wayne Litherland immediately after his first flight!

The Weitzel family with their partially completed Defiant. They also have two flying VariEzes which they use to blow away the cobwebs between building sessions!

SKETCHES OF VORTILONS OMITTED

THE CANARD PUSHER NO 48 APR 86

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 48. If you are building from 2nd Edition plans you must have newsletters 18 through 48. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 48. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 48. If you are building a Long-EZ you must have newsletters from 24 through 48. If you are building a Solitaire, you must have newsletters from 37 through 48. If you are building a Defiant, you must have newsletters 41 through 48.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
RAF is open Tuesdays and Fridays only. This also means we are only available to answer phone call questions on Tuesdays and Fridays. Do NOT call for builder support on Mondays, Wednesdays or Thursdays, you will get a recorded message.

We still talk to lot of builders as well as flyers of RAF airplanes and we do enjoy keeping in touch. If you have any construction problems or flying qualities questions, don't hesitate to drop us a line or give us a call.

If you come up with a good idea, an easier or better way to do something, or you just took a neat trip in your airplane that you would like to share with other flyers, let us know. In order to keep the CP

newsletter going and to provide useful information for builders and flyers, please keep those letters coming.

Mike was extremely fortunate a few weeks ago when Dick Rutan offered him a ride in the Voyager! Jeana was not in town, she was back in the Midwest adding a couple of ratings to her pilot's certificate. A test flight had to be flown, and since there was so much to do during a test flight that a co-pilot is a necessity, Dick invited Mike to go along.

Mike reports that it was a tremendous experience and that he is really impressed with the airplane and the team which is now rapidly moving toward the goal of world flight. The date has been set, Sept. 14, 1986 (weather, or course, permitting). It is not too late to help them along. Send a few dollars to: Voyager, Hangar 77, Airport, Mojave, CA 93501.

Look for an article in an upcoming Sport Aviation which details Mike's experience in this incredible flying machine.

SUN-N-FUN 1986
Unfortunately, due to other commitments, no one from RAF was able to attend this fly-in. However, we have received reports from several builders/flyers who did go.

Once again, there were more composite type airplanes there than any other kind, including approximately twenty EZ types, ten Glasairs, one Q2, one Velocity, etc.

The Sun "60" Race was held again this year over a slightly different course, 67.7 nautical miles (76 statute miles). This race is a flat out race from a standing start with no consideration for fuel flow, miles per gallon or cabin load. This race sorts the fast ones from the slower ones and, generally, is a really fun race. Of course, as in any race held around a closed course, navigation has to be dead accurate or you will not win!

This year the race had a much broader variety of airplanes from Glasairs to Long-EZs to VariEzes to Cozy, to Cassutts to a Velocity and a TC-2.

It is interesting to note that while most of the EZs posted ground speeds very close to their owner's manual speeds, most of the other makes certainly did not. The moral? Don't always believe the performance figures quoted in the color brochures!!

Place	Name	Aircraft	Eng.HP	Time	SpeedMPH
1	Richard Poter	Glasair-RG	180T	21:20.5	213.68
2	Charles Largar	Glasair-RG	180	21:33	211.50
3	Donald Yoakely	Glasair-TD	160	21:44	209.85
4	James Cline	Glasair-TD	160	23:13	196.38
5	Neil Hunter	Long-EZ	160	23:55	193.63
6	Steve Wiggins	Long-EZ	160	23:63	192.98
7	Danny Mayer	Velocity	180	24:22	188.27
8	Paul Mason	VariEze	115	24:33	187.42
9	Steve McCaskie	Long-EZ	115	24:33	187.42
10	Ed Albers	Cassutt	100	24:42	186.73

11	Jack Fehling	VariEze	100	25:32	180.09
12	Nat Puffer	Cozy	115	25:34	179.95
13	Tim Gehers	VariEze	100	25:39	179.66
14	Jim Rutland	Long-EZ	115	25:56	178.40
15	Ken Wheeler	TC-2	100	26:85	169.83
16	Gary Price	VariEze	108	26:85	169.83
17	Robin Yound	Glasair-TD	160	26:86	169.77
18	David Haggard	Long-EZ	115	29:83	152.87
19	Dick Dobson	Glasair-TD	160	34:43	134.44

Sadly, this year there were several accidents associated with getting to or during the flyin. A good friend with probably the high-time Quickie, Doug Swanningson, was killed in his well-known "painted like a waving American flag" Quickie. We will miss Doug, he had almost 1000 hours on his rather stock Onan-powered Quickie. A Q-200 and a T-18 were both involved in fatal accidents. Our sympathy goes out to those bereaved. With Oshkosh not too far in the future, it is time to review our piloting skills. Perhaps a ride with an instructor to brush up and point out potential bad habits that tend to creep in! During take-off and landing especially, we must be at 100%. Practice flying a slow approach such as may be forced on you in the Oshkosh pattern. Do it up high and see how your own airplane behaves at low speed. Watch out for getting too slow on short final, a high sink rate can develop very rapidly resulting in a very hard arrival that can easily break a prop or nose gear - or even main gear! Proficiency, knowledge of your limitations and your airplane's limitations can make all the difference. Do yourself and every member of EAA a favor, get a few hours of serious, quality practice (with an instructor?) before you set out for Oshkosh 1986.

GREAT AMERICAN PROPS APPROVED IN AUSTRALIA

Fred Griffith, president of Great American Props reports that after a recent trip to Australia where he visited a number of EZ builders, he has received notification from the Australian equivalent of the FAA that Great American Props are now approved for use on both VariEzes and Long-EZs.

This is good news for Aussie builders. All GAP props for EZs will be carved from certified multi-laminate hard maple blanks. The number of laminations has recently been doubled because Fred now orders 1/16" laminated blanks instead of the 1/8" laminates they have used up 'til now.

Great American Props recently subjected a few of their props to an extremely thorough physical properties test by the engineering department of Cal Poly in San Louis Obispo, CA. These props came through with flying colors. Any builder choosing to use one of these props can rest assured that there is no stronger wood prop available. If you are using one these props, you can torque the prop bolts to 300 in./lbs., the normal limit for a 3/8-24 aircraft bolt, without crushing the hub at all. If you are using one of the early GAP props using only 5 laminations of birth, you are limited to a maximum of 220 in/lbs. If you exceed this limit, you will crush the hub and then the bolts will

be loose. This is also true of any other propmaker's product which uses the 5 laminate birch, beech, or maple prop blanks.

EDGES OF AMERICA - A photographic essay of our border towns and their people.

JOHN FAULKNER, VariEze builder and photographer and art teacher will fly his recently completed VariEze around the perimeter of the 48 states taking aerial and ground photographs of people and places along the way. This ambitious trip will begin in June and end in August. John will begin and end his trip in his home town of Wallingford, CT and is planning on visiting Oshkosh during the 1986 convention. This trip will cover some 9500 nautical miles and take him through some 30 states. John plans on shooting about 4000 photographs, all in black and white.

A selected group of these photos will be on display during January 1987 at the PAUL MELLON ARTS CENTER in Wallingford, CT. Good luck with your project, John. Drop by Mojave if you can!

VORTILONS ON EZ'S
We continue to receive glowing reports from EZ flyers who are very pleased with the results of installing the vortilons on both VariEzes and Long-EZs. Don't miss out on these definite improvements. Vortilons are now mandatory on VariEzes and Long-EZs (regardless of which canard you have). Do NOT slit the wing leading edge to install the vortilons. This will weaken the wing, particularly in a VariEze which has a monocoque wing structure. Vortilons should be installed per the CP recommended procedure. Make the vortilons with small flanges as shown in CP 42, page 7 (VariEze) and CP47, page 15 (Long-EZ), finish them in your trim color, and attach them to the leading edges using RTV silicone.

DEFIANT NEWS
N78RA is finally looking like her old self. Cowlings are now white with the appropriate trim. Almost all of the little wiring glitches we had are corrected and all systems but one are working well. Unfortunately the one system not working is the rear prop. This is a Hoffmann constant speed, feathering prop and so far it has defied every effort we have put out to make it work right. The front prop works fine, right to the book, but we cannot get the rear prop to hold RPM.

We have been systematically chasing down every possibility we could think of and several suggested by the prop governor manufacturer, as well as a few from Hoffmann. So far nothing has worked. We were very close to believing that it must be internal in the engine when we received a call from Dr. Frank Yost of Muscle Shoals, AL. He has exactly the same problem, front prop works fine, but rear prop will only hold 2700 RPM for a short period of time before it starts to slowly loose RPM. This is exactly the symptom we have on N78RA! Dr. Yost's engine man, Ray Lett, has done a transfer gland leak check on his engines as well as two other engines. All are the same. We conducted the same test on both of Burt's engines as well as a third engine similar to the Defiant's engines. All three of these were essentially the same and the same as Dr. Yost's, so we are reasonably certain it is not the engine. It is certainly not the prop governor, we have had three on Burt's rear engine, including one that we had

specially built up to have as low an internal leak rate as possible. Nothing so far has made the slightest difference to the rear prop.

It is not unsafe to fly at this point, so we have been doing some flying, although almost all of it has been related to checking the various changes we have made trying to get the rear prop to work. We have managed to measure some performance numbers but none of these show any maximum performance since we cannot get the back prop to allow the engine to turn up. We are currently talking with Hoffmann about the problem, but this is difficult due to time and language differences. We do intend to get this problem worked out but, frankly, it has been an incredibly frustrating effort for all of us who have been involved in the project. Looking at the cost, both in man hours and money, unfortunately we would have to say at this point that it was not worth it.

Burt has not made any decision about approving the constant speed props for the Defiant. At this time, they are not a RAF approved installation. We still believe that, by far, the best bet is the original, simple, fixed pitch wood prop version and would strongly recommend that for all Defiant builders, at least until they are very thoroughly familiar with their own Defiant.

No new Defiants are flying yet that we know of, but Bydrell Mathews of Houston, TX surely would have been flying if it were not for a freak storm that raged across northern Texas smashing the Hull Airport and destroying the hangar where Bydrell had his completed (painted white Imron) wings stored. Both wings suffered damage, one winglet was severely damaged. Bydrell is busily repairing the damage now and should be flying by the time you read this. Good luck, Bydrell.

Charles Simms, Defiant builder of Deer Park, TX would like to point out a "gotcha". On page D-37, the main landing gear strut is called out to be 5.75" as a BARE LEG. This dimension is very important and must not be any longer that 5.75" before you layup the 15 plys of torsional glass wraps. Check your gear legs before you do the layup or you may not be able to fit the completed main gear strut into the slot behind bulkhead 144.5. If your BARE MAIN GEAR is wider that 5.75" as called out, sand it down. This will allow you to finish up with the correct 5.9" dimension after the torsional layup is complete.

SOME RECENTLY ACQUIRED PERFORMANCE NUMBERS FOR N78RA
Full throttle, best power mixture.

ALT	RPM	MAP	KIAS (kt)	APPROX TRUE KNOTS	AIRSPEED MPH
8,000	2,500	23	165	190	218
10,000	2,500	21	158	188	216
12,000	2,500	19.5	150	185	213
14,00	2,500	18	141	179	205

LECTURE TIME! EXCESS WEIGHT/WORKMANSHIP
We have not had a weight lecture in a long time, so please bear with us! We have seen quite a number of airplanes and parts of airplanes recently, and there are a couple of things that are showing up. The good news is that the average workmanship (glass work) is good, much

better than it was a few years ago. We still see an occasional example that makes us wince, but generally, the quality of glass layups is very good.

The bad news is that most builders, VariEze and Long-EZ, seem to have lost the incentive to build light airplanes. We see heavier and heavier examples. 700 lbs. VariEzes and 950 to 1000 lb. Long-EZs!! This is very bad, guys. Perhaps this is in part due to the

---

tendency to put bigger and bigger engines in these airplanes? Whatever it is, keep in mind it is a snowball, the heavier you build, the more it takes to make it go and the heavier that makes it! There is no way to get ahead taking that route. The solution is to be very conscientious about weight all the time while building.. Resist the temptation to add "fru-fru", unnecessary items that just add weight.

We have flown dozens and dozens of examples of both VariEzes and Long-EZs. Without exception, regardless of engine/HP installed, the lightest examples are always the best flying, most fun to fly.

Keep in mind that the prototype VariEze N4EZ weighed 594 lbs. and the prototype Long-EZ weighed 790 lbs. (and this airplane had a 50 lb. center-section spar due to the "plug-in" wings it had when first flown!). There are a number of EZs flying that beat these numbers easily. A 1,000 lb. Long-EZ is like flying the prototype all the time with a 200 lb. passenger on board! Regardless of the engine/power installed, it is still more fun to fly the prototype and much, much more economical!

BUILDER HINTS

Elevator trailing edge up travel (nose down command) on the new Roncz 1145MS canard continues to cause some builders' problems. Jigging the elevators per CP47 which enables the builder to look at the actual travel BEFORE he floxs hinges into the canard has certainly helped to avoid getting things permanently assembled with not enough clearance. However, the cause of the problem has not been clearly determined.

Looking closely at several homebuilt examples. we have noticed in almost all cases, a tendency to build the elevators too thick. This extra thickness is always all on top of the elevators and that seems to be why the elevator nose down travel becomes a problem.

Why are elevators being built too thick? One reason might be that the elevator templates in the plans, particularly the holes running the length of each elevator for the torque tubes, may be letting you hot wire cut an undersized hole. The 1" diameter torque tube, when forced into this, perhaps undersized hole, swells the top shape of the elevator.

When you make your elevator hot wire templates, sand halfway through the line, or possibly even a little more than that. When sanding in the area of the 1" diameter hole, sand the line off entirely. The hot wire temperature can also make a big difference, especially on such a small part as an elevator. Too hot of a wire will cut an undersized

elevator with an oversized hole, while too cool of a wire will cut an oversized elevator with an undersized hole!! Complicated, huh? Anyway, after you have cut your elevator cores, stand then on end atop the full size drawing on page C-1 and compare them. If they are oversize, a little careful sanding can bring them into perfect size. If the 1" diameter torque tubes do no want to go into the elevator cores easily, sand them until they do. After these torque tubes are micro-ed in and cured, carefully sand the excess "ears" of foam off and again check them by standing them up on top of the full size elevator drawing. If necessary, sand them until they fit. Elevator shape and size is very important, and a little extra time spent now will pay off handsomely when you go to hinge your elevators to the canard.

A leveling device that is very useful is a water level. This consists of a 30 foot long piece of hardware store type plastic or vinyl tubing with 1/2" I.D. Fill the tubing with colored water (food coloring), hold the two ends together and mark the water level at each end. Now, to use the water level to check, for example, the wing tips for relative height, hold or tape one end of the tubing on the reference wingtip with a water level mark on the reference point. Go the the other wingtip and raise and lower the other end of the tubing until the water is at the mark you put on the tube. This works great and does not have any sag in it like a tight string does.

Don't get the tubing too small in I.D. because the capillary action of the water will disturb the accuracy. Don't fill the tubing too full! Allow at least 12" from water level to top of tube. Do not cap the tubing! When you are not using the water level, twist a loop of safety wire around each end and hang them on a wall or door frame to prevent spilling.

Sanding blocks. We all know what a pain it can be to glue sandpaper to a hard block. Contact cement gets lumpy. It is difficult to remove "used up" sandpaper, etc. Well, this it it. The time tested method used by the sailplane wing contouring experts. FEATHERING DISC ADHESIVE, part #51135. number 08044, made by 3M. This is a spray can of glue - accept no substitute. Reportedly, no other product, regardless of their claims, works as well. Follow the instructions on the can to the letter to stick your piece of sandpaper to your block of wood. Now, when the sandpaper is worn out and you need to remove it, use a fingernail to pry up one corner and, using a small (cheap) paint brush, brush a little Dupont fast dry enamel reducer, part#3812S under the sandpaper. Just a few drops will allow the brush to almost miraculously peel the sandpaper off. Again, accept no substitute.

This combination was arrived at after literally years of experimenting and testing. Usually you can reuse the glue for 3 or 4 sheets of sandpaper. If you start to build up too much glue and get lumps, use the 3812S to remove excess glue. This system works really great and can make the contouring, finishing, priming and painting process a lot less frustrating. Try it, you'll like it!

NOSE GEAR MISTREATMENT

We have noticed a growing tendency among EZ owners to set the nose gear at one-half to two-thirds down and then leave the airplane sitting on its 3 wheels. This is asking for a stripped worm gear in the retract mechanism. Take a look at the drawings. It should be obvious that the

worm/worm gear never sees the load. With the gear down and locked, the pushrod is in an overcenter position and takes all the load in compression. The worm/worm gear mechanism only takes the weight of the gear driving the retract/extend cycle and that is all it is ever designed to do. It cannot carry the weight of the airplane and will strip instantly if you ever allow it to "see" the weight of the nose plus a pilot. Park it nose down, or tie it down with the nose gear extended.

VARIEZE TYGOTHANE FUEL LINES.
Leo Brosche of West Pasco, FL reports that after leaving his VariEze setting in a hangar with fuel in it for a 1-1/2 year period, all of his Tygothane fuel lines deteriorated to the point of total failure with hundreds of small cracks all over them.

We have seen this at least once before and have cautioned VariEze builders to watch for this problem. According to the manufacturers, the Tygothane is essentially not affected by fuel but water will destroy it over an extended period of time. If you still have Tygothane fuel lines in your EZ, check and/or replace them often. Or better yet, plumb the airplane per the Long-EZ, using only standard aircraft fittings and hoses such as the Aeroquip 600 series.

CAUTION
We have noticed a few builders who have connected all four fuel tank vent lines on a Long-EZ to a common manifold then ran a single vent line up through the skin presumably because it "looks nice"?! This is a no-no! This completely defeats the main reason for the multiple fuel tank vents - REDUNDANCY. With a single vent line, one mud wasp can cause you to loose your engine even though you have two tanks full of fuel. Each fuel tank requires at least one independent vent. If you have totally sealed fuel tank caps, you need two separate vent lines per tank. Don't compromise here, this is a flight safety item and could seriously ruin your day, maybe even the rest of your life.

CAUTION
ELEVATOR CONTROL STOP POSITION. This applies to VariEzes as well as Long-EZs using the original GU canard (Roncz 1145MS not affected). The design philosophy of the EZ canard type airplane calls for the canard airfoil to develop maximum lift coefficient (CLmax) at full aft stick. Thus the elevator trailing edge down (nose up command) stop must be set correctly. On an accurately built GU canard/elevator, this will usually be at approximately 22 degrees (trailing edge down).

Recently, we have heard from a few builders, both VariEze and Long-EZ, who have noticed stall characteristics that were not "per the handbook". In all cases, the cause was the elevator nose up stop set to allow too much elevator travel. If you have noticed any of the following symptoms, check that you have no more than 22 degrees to 22-1/2 degrees trailing edge down travel on your elevator.

1) Perform a 1-'g', wings level, straight ahead stall with sufficient power to maintain level flight. Slowly pull the control stick back to full aft stick. This should result in a nose high attitude with a

"pitch bucking" that can vary from hardly noticeable to quite vigorous, perhaps "one buck" per second, with a deck angle change of several degrees per "buck". This is normal and will vary depending on the cg. If, however, you notice a strong stall break (canard stalls) and the nose comes down through the horizon until you are in a stable shallow dive, even though you are still holding full aft stick, the speed may build up to over 100 KIAS before the EZ begins to climb again. This very long period pitch "bucking" can be as long as 30 seconds per cycle and is indicative of too much elevator trailing edge down travel. You can verify this by releasing back pressure on the stick during the nose down phase of the cycle and gently raising the elevator trailing edge perhaps 1/8" at a time.

This should allow the canard to develop more lift and pitch the nose up. Try to determine by experimenting with elevator position, where CLmax is, then set your elevator stop at that position.

2) Another classic symptom may be noticed during a take off. At full aft stick, it may take a longer take-off roll to lift off that it does at, say, slightly forward with the stick. If you have ever noticed this, it should be corrected. Under certain circumstances, this could become a serious problem. A Long-EZ builder/flyer in Alaska, attempting to take off on a rather short runway, discovered that he was rapidly approaching the end of the runway and, even though he was holding the stick all the way back, was not rotating. Realizing he was not going to make it, he backed off from the full aft stick stop and, to his surprise, the airplane literally jumped into the air! Again, his trailing edge down elevator stop was set for too much travel. This same scenario has also been reported to us by a San Diego VariEze pilot.

What causes this? If the elevator stop is set so that at full aft stick your canard can develop its maximum possible lift, this will result in the lowest possible rotation speed for take-off and a good, clean canard stall (limiting the main wing angle of attack) or classic "per the book" stall at full aft stick in flight. If, however, you have set your elevator stop for too much travel (perhaps you thought you could lower your rotation speed?!!) what happens is that you are now on the "back side" of the lift curve, lift is less than maximum, and the elevator is creating lots of drag. The result may be running off the end of the runway. Keep in mind that this condition could be aggravated even further if it were raining.

CAUTION
Low Fuel Pressure on Cont. O-200 Powered Long-EZ's
The mechanical fuel pump on a Continental engine is prone to being heated by hot cylinder air. This can reduce fuel pressure to near zero, particularly at altitudes above about 8000'. This fix is to build a cooling shroud from 3 plys of BID, to fit around the fuel pump with about 3/8" clearance all around. A 1" diameter blast tube, ducting cold, high-pressure air to the BID shroud will correct this problem.

FOR SALE
TWO (2) Lycoming O-235-C2C engines with logs. Both "runout". These engines were running when they were removed from the Voyager. Yes, these are the two engines RAF installed on the Voyager for its initial

flight testing. $2500.00 each. FOB Bldg 13, Airport, Mojave, CA 93501. Contact Mike or Joan 805-824-2645.

VariEze Continental O-200. Flight Research stainless exhaust system with mufflers and carb heat muff. Cost-$350.00, never used. Sacrifice for $150.00. Contact: Phil at 818-352-0326.

Wes Gardner is still selling his excellent, reusable foam air filters. Wes has some other neat "EZ" items. A retrofittable fuel sight gauge, for those with poor translucency in their gauges. An oil separator system for the Continental O-200 and the Lycoming O-235 that is guaranteed to remove all traces of breather oil mess on your cowling. Contact Wes for more information:

Wes Gardner
1310 Garden Street
Redland, CA 92373
(714) 792-1565

RAF RECOMMENDED PROP MANUFACTURERS
The following are manufactures of props that have been "tried and tested" by RAF and are considered your best buys.

B and T Propellers
Bruce Tifft
3850 Sherrod Road
Mariposa, CA 95338
(209) 742-6743

Teds Custom Props
9917 Airport Way
Snohomish, WA 98920
(206) 568-6792

Great American Props
1180 Pike Lane #5
Oceano, CA 93445
(805) 481-9054

INTERNATIONAL VARIEZE AND COMPOSITE HOSPITALITY CLUB
IVCHC was founded in 1979 by Donald and Bernadette Shupe of California to encourage and promote hospitality, travel, and support for builders and pilots of VariEze and Other Composite aircraft.

A Quarterly newsletter is published that contains letters from members on safety, first flight reports, builders hints, and information on past and future club flyins.

A list of members is published yearly with quarterly updates. These lists are provided to all members but they are CONFIDENTIAL and are NOT to be duplicated, posted, or shared for any reason with nonmembers.

Members are expected to provide emergency assistance, shelter and comfort to other members according to their ability to do so. Courtesy demands as much prior notice as possible of an impending visit be provided the host by visiting dignitaries. The major complaint we get from members is that they are not visited enough. Members who are still building especially treasure visits from flying members who can provide lots of talk, examples, and occasional rides.

Club members have frequent lapses of sanity and take on the task of hosting a flyin. They have complete freedom to do this when and where they please. All we ask is that they take credit for their

accomplishment and simply send us the notice for the flyin and a report after the event (and perhaps recruit a few new members).

IVCHC hosts a Fantastic banquet at Oshkosh each year with an average of 240 attendees. The "Real" George Scott, IVCHC 1984 recipient of the Ed Hamlin Memorial Trophy, has been the Organizer and Chair of Ceremony for the Banquet for several years. A few well established and successful flyins are ones like the Dickey's Jackpot Flyin and Air Race and the Brookridge Airpark Fly & Drive in by Buzz Talbot et al.

IVCHC members support other members by lending, replacing, and repairing parts and extending aid and comfort to any member who has become stranded in their vicinity. Members who have been helped are only expected to replace whatever they have borrowed and cover any expenses of the helping members.

When people visit you, they are expected to cover all their own expenses including food and transportation. It should not cost you to be a host. The most common hosting task is to pick people up at the airport, provide a bed overnight or two, sometimes a meal or two, and then take them back to the airport so they may continue their journey. (We recommend that everyone gets a credit card call number).

It is very comforting to know that no matter where you are in the world, if something should go wrong or you need a place to stay there will be a member within a few hundred miles. Help is never far away if you keep an IVCHC Membership list with you while you travel.

If IVCHC sounds like an organization that may fit your needs and interests, please join us by filling out the attached form and send it with a check for $14.00 domestic (U.S.A. and Canada) or $17.00 Overseas, and mail to:

SHUPE/IVCHC
2531 College Lane
La Verne, CA 91750

IVCHC NEWS
The International VariEze Hospitality Club is now called "INTERNATIONAL VARIEZE AND COMPOSITE HOSPITALITY CLUB" -- to include members who are building Long-EZ, Defiant, Cozy, Quickie, Lancair, Glasair, etc.

The IVCHC had just published it's NEWSLETTER #28, and is now into its 8th year! To celebrate this very special occasion, the IVCHC founders -- Donald & Bernadette Shupe -- would like to invite you to join their CLUB ACTIVITIES this year.

PROSSER STATE'S DAYS
MEMORIAL DAY WEEKEND FLYIN
For more details contact Sue Husa
1821 Wright Ave., Richland WA 99352
(509) 943-3693

JACKPOT, NEVADA, FLYIN AND AIR RACE
July 4, 5, 6, 1986

Cactus Pete's Resort 1-800-821-1103
(about $37.50 per night, double occupancy)
For more details contact Shirl Dickey
1646 Allegheny Drive, Murray UT 84123
(801)258-3360

EZ AUTUMN ADVENTURE
COLUMBUS DAY WEEK-END, OCTOBER 10-13, 1986
ROUGH RIVER DAM STATE RESORT
Falls of Rough, Kentucky
(lodging $32.00 or $40.00, depending ....)
For more details contact Buzz Talbot
222 Sunshine Drive, Bolingbrook, IL 60439
(302)759-1124

MEXICO ADVENTURE
NOVEMBER 1986
For more details contact David Kolstad
9955 Babbitt Ave., Northridge, CA 91325
(213)860-1418

*****YOU ARE ALSO INVITED TO JOIN THE IVCHC*****

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

VARIEZE

In CP47, pg. 6, we recommended separate, independent fuel tank vents for the VariEze. This is a mandatory plans change and is designed to offer redundancy should one vent become clogged by a mud wasp as was reported in CP47.

LONG-EZ

LPC #127
A mandatory inspection of your nylon brake lines is required before next flight. If these brake lines have been directly exposed to radiating heat from the brake discs, or to sunlight (UV) they must be replaced.

LPC #128
Main gear attach. Inspect with a mirror and a flashlight to determine if the gear attach tabs have slid aft on the LMGA steel tube. We have received two reports of this from Long-EZ flyers. This is not a structural problem, but may cause the nylon brake lines to be pinched between the trailing edge of the main gear strut and the fuselage side where the gear comes out of the fuselage.

If you find any evidence of movement in this area, please let us know. Pry the gear forward to its proper position on the LMGA tube then fill the gap between the aft attach tab and the aft aluminum extrusion on each side with flox. Allow to cure for 24 hours before flying.
SKETCH OMITTED

LPC #129 Long-EZ Roncz 1145MS Canard Plans. The NC-2 elevator hinge inserts must be installed correctly as shown in the full size cross section drawing, page C1. The hinge pin hole should be aft as shown.
SKETCH OMITTED

SOLITAIRE

SPC #60
Solitaire section 1, page A-22. The cable arrangement for the operation of the spoil flaps is reversed. The wrong cable is shown connected to the SSF-3 spoil flap actuator.

DEFIANT

DPC #38
Section 1, page D-51. Canopy latch. A small notch should be filed in part #LOC-6 to allow part #LOC-7 to swing up far enough to let part #LOC-2 slip into the receptacle assembly. Without this small notch, the #LOC-2 tab will not clear #LOC-7 **SKETCH OMITTED**

VARIEZE/ROSENHAAN AXLES
Good news! Clyde Hamilton, VariEze builder/flyer has decided to go ahead on his own and have several sets of these axles manufactured. They are machined out of steel and the flange is welded on. The weld is done by a certified aircraft welder.

Contact: Clyde Hamilton
6362 Glenknoll Drive
Yorba Linda, CA 92686
(714)970-7231

CAUTION
Very recently while reading copies of the various EZ support newsletters that are currently being produced all over the US, we came across a couple of bad suggestions. One of these is of great concern, a suggestion to use WD-40 Silicone lubricant to lube and cool the counterbore tool while drilling the wing attach holes in the wings and centersection of a Long-EZ. NO WAY, NO HOW, NOT FOR ANY REASON must you use WD-40 or ANY similar silicone type lubricant to help you drill these holes. Plain water is as much as you can do. Getting silicone lubricant onto any glass surface will absolutely guarantee that you will never be able to get anything to stick to that area again. Epoxy will not stick, nor will primer or paint. In short, you have a major problem on your hands. The wing attach bushings must be glued into these holes securely with flox. WD-40 will not allow you to get a bond in this area. This is a very foolish and dangerous suggestion - do not even think about doing it.

The other suggestion which was printed in the EAA Designee newsletter, was to use a salt shaker to sprinkle micro balloons onto an uncured layup for future contouring. We do not like this idea for two reasons: It makes it impossible to inspect the layup after it cures, which is unacceptable and in order for the dry micro balloons to wet out they must be leaching epoxy out of your layup.

If you have already done a good job on the layup, which you obviously should have done, if you are following the instructions in the plans, you are then causing what might have been an excellent layup with the correct epoxy to glass ratio to become a starved, dry layup, which you would never be able to check.

Be very careful about getting away from the basic plans and instructions. These methods have been developed and tested over a number of years and hundreds of airplanes. Fooling around with the structural integrity of your EZ could result in a serious accident.

DYNAMIC PROP BALANCING ACT
A few weeks ago, Jim Fackler brought a Chadwick balancer up to Mojave to check the balance on the props of the Voyager. While he was here, Bruce Evans persuaded him to check the balance on his own VariEze prop and one thing led to another and before poor Jim knew what had happened, he had a flock of VariEzes, Long-EZs and a Defiant waiting in line!

Jim told us that he really did not do this kind of thing for a living. Basically what he does is sell the Chadwick/Helmuth balancing equipment, but said he would be willing to help out the EZ flyers who may be interested in getting this done. He does it on his own time and an appointment would have to be made with him. Jim charges around $100.00 and what you get is a very accurate tachometer check (he uses a strobe) plus, he checks the track of the prop, that is, while it is running the two blades are running in the same plane. If not, he can tell you how far out they are. Then he mounts an accelerometer to the

engine and has you run the engine at several different RPMs. His equipment prints out a graph which shows all the vibration characteristics of your engine/prop/spinner combination. Then you shut it down, while he calculates how much out of balance your particular prop may be. He will mount a washer or two on an AN4 bolt through the starter ring gear and have you run it again. That is usually all it takes. With a particularly badly out of balance airplane, he may require one more engine run.

There were six of us who had their airplanes checked by Jim a few weeks ago. All of us were very pleased with the results. Noticably smoother across the board. We did notice however, that after four or five flights in the airplane that the advantage that we had gained seemed to go away. Bruce and Mike noticed this and decided to remove the bolt and washers Jim had added. One flight without the added balanced weight was enough to convince them that it really had made a significant difference and that it was worth the time and the money.

Even if the difference is not all that noticeable to the pilot, you can see on the "before and after" graph printouts that Jim will provide to you, that the vibration peak of the prop is reduced considerably. This must mean less stress on the whole engine/airframe over the long term - see photos for details.

If you would like to get your engine/prop dynamically balanced, a couple of things you can do to help you get the most out of it, is to carefully balance your prop (statically) and check the track when you mount it on the airplane. Keep in mind that Jim will balance the prop even if it is way out of balance. Once this is done, you will have to leave the prop "out of balance" or you will have to have it done again. Give Jim a call after work in the evenings at his home - (818)285-2064.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Jim Fackler checking out his Chadwick/Helmuth prop balancing equipment.

The Chadwick/Helmuth spectrum analyzer in action, printing out a graph showing "g" peaks and valleys.

Accelerometer mounted on Burt's Defiant, rear engine.

N78RA, Defiant during wiring for the dynamic prop balancing run.

Jim Fackler (left) and Bruce Evans discussing the best location on the wires to the accelerometer shown just aft of the starter ring gear.

Sam Kreidel watches Jim as he checks prop tip runout with his strobe on Sam's beautiful Long-EZ.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Aub Liebig taxies out for take off in his recently completed Long-EZ at Waikerie Aerodrome in Australia.

Graham Singleton and friend Joan preparing for a flight in Graham's Long-EZ in England.

Fry Vanlentino's unusual VariEze just prior to going to the airport. Bumps on the cowl are due to Switzerland's strict minimum noise requirements.

Peter Van Rensberg of Pretoria, Republic of South Africa, built this Long-EZ shown in his yard just prior to going to the airport. Peter reports that she flies beautifully, "stable as a rock".

Robert Hughes of Pembroke Pines, Florida getting a little stick time!

Marcus Borom from Schenetady, New York shows off his Long-EZ in his front yard.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

RAF received the following pictures from "Captain Val". Captain Val is building his own composite design. The story goes that he was wondering how to trim and shape the fuselage when his wife asked him when he was going to trim the hedges. He went to the garage and found the hedge trimmer and says "the light came on". As you can see he made short work of trimming the fuselage!!! Captain Val got so carried away trimming foam, he had trouble finding his epoxy pump!!

From the archives! Circa 1974, Burt and helper Gary Morris rigging an early VariEze airfoil on the old Dodge powered wind tunnel, which Burt used to gather full scale airfoil data for his prototype VariViggen, N27VV, the proof of concept VariEze, N7EZ and the prototype VariEze, N4EZ.

Marcus Borom positioned his Long-EZ almost vertically in order to prime and paint it! A neat idea, we did something very similar when painting the prototype Long-EZ, N79RA.

SUPPORT THE CANARD PUSHER!
If you enjoy the Canard Pusher, and would like to see it continue in its present form, we need your help! Please send in photos of your projects, or your flying airplanes. We need builder hints, better or easier ways to do things, suggestions, corrections to the plans etc.

We enjoy putting out the CP, it really has become a way of life, almost an institution here at RAF but lately we have received very little feed back from builder/flyers. We need your support and you may be able to save another builder from making the same mistake you did or even prevent a possible accident. If you have information that may be helpful to other EZ builders and/or flyers or if you have had an interesting or unusual experience in your EZ, sent it in. This is really what the CP is made up of, the builders and flyers input.

CP48, Page 9

An excellent view of Fred Keller's Defiant instrument panel. This photo was taken by Don Downie while he and Fred were flying over the mountains west of Mojave. **PHOTO OMITTED**

CP48, Page 10

THE CANARD PUSHER NO 49 JULY 86

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 49. If you are building from 2nd Edition plans you must have newsletters 18 through 49. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 49. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 49. If you are building a Long-EZ you must have newsletters from 24 through 49. If you are building a Solitaire, you must have newsletters from 37 through 49. If you are building a Defiant, you must have newsletters 41 through 49.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

VOYAGER CLOSED COURSE RECORD ATTEMPT
Dick and Jeana took off from Mojave just after 8:00 AM on Wednesday morning, July 9th. After flying for about 7 hours, the electric variable speed prop on the rear engine developed a problem and Dick decided to land at Vandenberg Air Force Base to check it out. After a good nights sleep, they repaired the problem the next morning and then made the decision to try again. They took off from Vandenberg at 2:47 PM on Thursday, July 10th and flew up and down the California coast about 20 miles out to sea around a closed course that is 500 nautical miles per lap.

The decision was made not to chase the Voyager continuously, but to fly out and join up with them for an hour or two at dawn each day and then again for an hour or so before dark. The reasoning here, of course,

was to be able to assure the crew that there was no visible problems such as oil or fuel leaks.

On Friday evening, June 11th, Mike, Sally and Mark Greenberg (a professional photographer) took off in the Voyager chase aircraft, a Beech Sierra, and with excellent help from LA Center, we were vectored to an intercept with Voyager 20 miles off the California coast at Big Sur. The sun was getting low in the sky, the ocean was sparkling blue and the Big Sur coastline was beautiful. All eyes in the chase were searching the endless blue skies. Center called them at 12 o'clock and six miles. Sally was the first to spot them, a thin, curved line in the sky.

As we closed with them, the air was glass smooth and the sight of the regal shape of Voyager, as it slowly floated back towards us, was breathtaking. Mark, the photographer, was shooting film, like a mad man as we slid into close trail formation to give the Voyager a quick look. She was absolutely clean, except for a thin trace of oil from the aft engine breather which is normal. Dick and Jeana were fine and sounded in good spirits. Both had managed to get some sleep and were very confident of the Voyager's ability to fly for almost four more days and nights!

We parked on their wing and floated up the coast beyond San Francisco. We chatted and took photos and they took photos of us. We made the north turn point at dusk. As the sun sank into the ocean like a ball of red fire, the Voyager looked magnificent against the skyline - the photographer was blowing his mind! As it got dark, we moved in very close for a thorough inspection of the machine, reported to the crew that they looked great, and said "good night". We were low on fuel ourselves and headed toward the coast to refuel at Salinas.

As we drifted away from Dick and Jeana, the silhouette of the Voyager against the night sky with the evening star and a two day old new moon just above her, it was a sight we will never forget.

As I write this, it is Sunday June 13th. I have just checked in with Voyager base and all is well. They are both in good spirits, both have managed to sleep quite well and the Voyager is running like a Swiss watch. Fuel condition is excellent and it is a "GO" for the record. The weather looks like it will hold, but a small system which may have some rain in it , is expected to move in on Monday night. I will be joining up with them again on Tuesday morning at dawn and will escort them home. What a superb effort - what a tremendous team, to have got this record attempt off in such good shape. Go for it Dick and Jeana, we are all pulling for you!

OSHKOSH 1986
Burt is planning on flying his Defiant, N78RA, and Mike and Sally will fly their Long-EZ, N26MS, to Oshkosh this year. We are planning on arriving on Thursday afternoon in order to set up the booth. It will be the same booth, G-7, which RAF has had for years but this year we will be sharing it with Larry and Michael of FeatherLite Products. Burt and Mike are hoping to be able to spend more time on the flight line visiting with the builders and looking at individual airplanes.

Burt's talks this year will be as follows:

Saturday - August 2 - 8:45 - Forum - Long-EZ & Defiant
Monday - August 4 - 8:45 - Plans & Kit Business - The Designer's Responsibility
Tuesday - August 5 - 2:45 - Next Generation General Aviation Aircraft

DEFIANT NEWS
There are now, at least 6 Defiants flying! Burt, Fred Keller, Johnny Murphy, Frank Yost, Mike Cardinale and Byrdell Mathews.

Mike Cardinale, based at Merrit Island, Florida, had his Defiant ready to go on May 28th and Johnny Murphy made the first flight. Johnny reported that the airplane flew well, it has 160HP Lycomings with wood props. Mike's empty weight is 1740 lbs. A few weeks later, during a landing rollout at low speed, the rudder/brake pedal assembly failed forward leaving Johnny with no rudder, no brakes and no steering. He shut down both engines and sat helpless while the airplane slowly rolled off the runway into a ditch, breaking the prop, the nose gear and fracturing the canard. No one was hurt, but the fix for the rudder/brake pedal assembly is mandatory and should be done before next flight. Mike repaired the airplane, built a new canard and has the airplane back in the air! He is presently flying off his hours and trying to finish up all the little details to get it ready for Oshkosh.

Byrdell Mathews had his Defiant ready some time ago, but as reported in an earlier CP, Byrdell had the heartbreaking experience of a tornado hitting his hangar. Both wings/winglets were damaged. He has since repaired the damage and has flown his first flight on June 18th. Empty weight is 1854 lbs. Byrdell started his Defiant project in August of 1984 - quite an achievement.

Johnny Murphy reports that his own Defiant is flying very well and that he is very pleased with it. He recently flew a couple of tests to see how much drag the constant speed props create when they are not feathered. He flew both examples at 4000 feet, two-place, with enough fuel to bring the gross weight up to 2500 lbs. The 160HP Lycomings with Hartzell constant speed props (not approved or recommended by RAF) provide good takeoff and climb performance, but when either one is shut down and not feathered (windmilling), the drag is so high that the good engine can only just hold altitude at 4000 feet and 2500 lbs. At 3000 lbs, gross, Johnny does not believe it would hold altitude. Once the dead engine is feathered though, speed increases almost 25 KIAS and the airplane feels real comfortable.

After many months of spasmodic (due to other commitments), work on Burt's Defiant, N78RA, the Hoffmann props are working. While takeoff and climb are excellent, top speed is disappointing and Burt feels that if he had to do it again, he would opt for fixed pitch, wood props.

DEFIANT PROPELLERS
Since that last newsletter extensive developmental tests have been done toward qualifying the Hoffmann constant speed/feathering propellers for the Defiant. At this time, we cannot approve this installation nor any

other constant speed installation on the aircraft and do not have an assessment as to whether this approval will be forthcoming.

The development of the constant speed propellers was initiated to improve the airplane in two areas, 1) take-off and climb performance and, 2) the ability to cruise at low rpm to increase fuel efficiency. Currently, our assessment is that the disadvantages heavily outweigh the advantages. There exists a specific and serious safety problem with the constant speed propellers on the Defiant. That safety consideration relates to the inability of the airplane to provide adequate climb performance with a failed engine unless the failed propeller is feathered. The reason this is serious is that due to the Defiant's centerline thrust configuration, the pilot does not have the adequate cue to assist him in recognizing which engine has failed. When an engine fails on a constant speed installation, the rpm and manifold pressure will generally remain the same without an indication of a failure. Thus, the pilot must guess which engine has failed and verify it with a throttle reduction before he makes his decision to feather the failed propeller. If he does not feather the failed propeller, the flat pitch of the constant speed propeller, unlike the low drag of the high pitch, fixed pitch propeller, results in inadequate climb and a dangerous engine-out situation.

Another safety concern is the structural adequacy of the propeller blades and/or propeller hub on the aft engine when operating in the flow field of the aircraft. The blades and hub are continuously experiencing bending vibrations. These vibrations have not been measured nor evaluated analytically and all indications from previous testing indicate that an unsafe blade or hub fatigue situation may exist.

Our experience within the last several years with several pusher configurations has shown this to be a serious problem. We had anticipated that the wooden blades on the Hoffmann propellers may alleviate the concern. However, recent testing with wooden blades on another adjustable pitch pusher installation has shown propeller retention bearing failures in less than 100 hours of operations. Thus, we must warn against use of any constant speed propeller installation on the Defiant and for the Long-EZ, for that matter.

JACKPOT 1986
Over 40 VariEzes and Long-EZs flew into Cactus Pete's Jackpot airport, just a stones throw south of the Idaho border and almost into Utah. This is high country, the airport is at over 5,000 feet elevation, the scenery is beautiful, the nearest town of any consequence is Twin Falls, Idaho. On the morning of the 4th of July, the winds were really blowing. Conditions at the airport were steadily getting worse with strong gusty crosswinds of 30 to 40 knots almost 90 degrees to the only runway. To the credit of the pilots, all but seven of the aircraft to arrive at the flyin managed to land without incident. A dinner show in the casino was enjoyed by all, followed by an impressive fireworks display.

On Saturday morning, the famous Jackpot 120 Races were held. Shirl and Diane Dickey go to tremendous lengths to make this both a fun and safe event. It is, however, an out and out race and the fastest airplane

will win. There are no tricky formulas or pilot techniques that can help you - it is a "no messing around" speed event.

The first race was for unlimited aircraft, those with larger than standard engines, and this year that event included a 160HP tail dragger Glasair. This race was very close, with the first three airplanes crossing the line within 15 seconds. The first seven airplanes averaged over 200 MPH!! The Glasair was soundly beaten by Long-EZs and VariEzes with similar power plants! The second race was for "standard Long-EZs" powered by 0-235 Lycomings. The third and final race was for "standard VariEzes" powered by Continental 0-200 engines. The three races went off without a hitch and some very impressive times were turned.

Following the races, a spot landing contest was held and this one always sorts out the pilots! Debbie Iwatate touched down only 11" from the line and we figured she was a shoo-in for the second year in a row. However, along came Joe Moore in his Rolls Royce powered VariEze and touched down just 8" from the line! Incredible.

Next, came the ribbon cutting contest which is always good for a few laughs. It looks alot easier than it really is. After that, everyone retired to the swimming pool and a little sun tanning.

Unfortunately, this year one of the Long-EZs was involved in a takeoff accident. The airplane veered off the runway and flipped over. Fortunately, the two people onboard suffered only minor injuries. The airplane should be repairable though probably not in time for Oshkosh.

Saturday evening brought the usual great banquet. Cactus Pete really does us proud. Over 100 people enjoyed the food and the conversation. After dinner, Shirl and Diane presented the prizes and trophies.

Jim Shultzman won Grand Champion, or People's Choice and was presented with a magnificent silver tray. This was the second such win Jim had received for his beautiful Long-EZ. He won Grand Champion at Porterville just a few weeks previous. The silver tray was conceived and presented by Ian and Chris Ayton who won this award last year. Race results as follows:

Unlimited			
1st Place	--	Mike Melvill	209.14
2nd Place	--	Dick Kreidel	207.66
3rd Place	--	Wes Gardner	205.56
Stock Long-EZ			
1st Place	--	Ian Ayton	182.91
2nd Place	--	Gus Sabo	181.00
3rd Place	--	Mark McHenry	180.25
Stock VariEze			
1st Place	--	Klaus Savier	207.90
2nd Place	--	Shirl Dickey	191.16
3rd Place	--	Joe Moore	186.75

Once again, many thanks to Shirl and Diane Dickey who, for four years in a row, have organized the best flyin there is anywhere. It was great! Don't miss it next year.

INTERNATIONAL VARIEZE AND COMPOSITE HOSPITALITY CLUB
FlyIn Update
Jackpot Air Race NV, July 4th Weekend

41 Composite Homebuilt Showbirds attended the great IVCHC Air Race which was fun, successful, friendly, and EZ - except the wind - as usual. Two members, Magnum & Glen Liset, were from Australia. And this year many EZ's clocked over 200 mph - breathtaking! Race winners" Unlimited - Mike Melvill, VariEze - Klaus Savier, Long-EZ - Ian Ayton, Ribbon cutting, 14 cuts "WOW" - Mike Melvill. Our special thanks to the Dickeys, members of the Air Race Support Team, and all the attendees for their wonderful support!

Prosser States, WA, Labor Day Weekend
Please contact: Ivar & Sue Husa (502)943-3693
1821 Wright Ave., Richland, WA 99352
Free steak barbecue to those who fly in plus "old time fiddler" band and a tour of the St. Michelle Winery at Paterson!

Rough River, KY, Columbus Day Weekend
Please contact: Buzz Talbot (312)759-1124
222 Sunshine Dr., Bolingbrook, IL 60439
All the previous available lodge rooms are taken, but Buzz has located two more motels: Sarver's (502)257-2771 & St. Clair (502)257-2561

Mexico Flyin, Thanksgiving Weekend
Please contact: David Kolstad (818)349-3274
9955 Babbitt Ave., Northridge, CA 91325
Puerto Escondido - Beautiful place according to Bruce Evans, #3 man in the Voyager! Flyin combines the Mexican EAA Chapter and AOPA.

IVCHC 1986 OSHKOSH BANQUET
Date: August 4, 1986 Monday
Time: 6:40 check in, 7:00 cash bar, 8:00 dinner
Cost: $14.00 per person (includes tax & tip)
IVCHC members may order tickets through mail with the deadline on July 18, 1986, or at Oshkosh in person. Non-members may purchase tickets at the RAF booth at Oshkosh on August 3 & 4.

Anyone interested in joining the IVCHC may send dues of $14.00 for USA & Canada or $17.00 for International members to:
IVCHC/Shupes
2531 College Lane
La Verne, CA 91750

IVCHC now also has really classy T-shirts, Patches, and Window Decals available to members!

LORAN-C FOLLOW UP
Sally and I have been flying a Micrologic ML6500 Loran-C for the past 250 hours. Once you have flown Loran it would be difficult to do without it, to say the least. The Micrologic is an excellent Loran, and for the price, is probably as good as you can do. We had a home-made antenna in the winglet and, in retrospect, I believe this was a

mistake. I believe the antenna should be a close as possible to the aircraft centerline. I say this because several EZ flyers I know who have the winglet antenna have the same complaint, drop out during maneuvering. Those with antenna on or close to the centerline do not report this problem.

Anyway, we sold our Micrologic and bought a new Northstar M1 from Dusty and Brenda. They have the best prices on the M1 that we could find. This Loran-C unit is the best I have seen, and I have flown most of them. It has an unbelievable data base of over 14000 waypoints and is the easiest to use of all the Lorans I have tried. Dusty provided the unit with the wiring including the antenna prewired to suit our Long-EZ. All I had to do was mount it and hook it up!

We bought the bent whip antenna with a tuned and matched pre-amp because we figured if we were going to spend this much money, we may as well go all the way to get the best possible performance. I installed the bent whip on the belly under the passenger's thigh support. I laminated a piece of copper screen about 20" x 30" onto the floor and layed up one ply of BID over this to hold it in place and to protect it. The antenna base is bolted to the copper screen as is the antenna pre-amp. In addition, I bolted a ground wire to the pre-amp, the antenna base, the Loran mounting tray and then directly to the battery negative terminal. This ground was in addition to the normal radio ground or 28 volt negative. The Northstar M1 operates on any voltage from 8 volts to 30 volts, and so far, we are ecstatic with our new toy!! We flew it on a cross country from Mojave to Twin Falls, Idaho, to Salt Lake City and back to Mojave and it performed flawlessly, never dropping out even during an aileron roll! This is without a doubt the neatest navigation device to become available to the homebuilder since the Long-EZ itself and I heartily recommend it. The general feeling about home-made antennas seems to be that the best results come from a wire stuck on the canopy. Bob Evans reports that he has tried them all and the one he likes best goes along the plexiglass just above the fiberglass frame from the front to the back, then over the top and back up the other side. The pre-amp must be for a long wire antenna and should be mounted on the canopy frame as close as possible to the antenna. Ground the pre-amp case and mounting tray directly to the negative terminal of your battery. If your alternator makes noise that interferes, you might try one of Bill Bainbridge's linear voltage regulators and/or a Loran filter in the main wire from the alternator to the battery. Mount this filter as close to the alternator as possible.

SHOPPING
UP-DATE FROM B & T PROPELLERS (and "The Beez") June 1986:

"Since it's been a while, thought we'd write an up-date on what's been going on with B & T Propellers since relocating to the beautiful foothills of Yosemite (central California).

We've found that many of the builders are doing lots of different and innovative things with their airplanes, engine-wise, these days and we've been busy keeping up with all these creative people. We've really been enjoying working on a more customized basis with many of the builders in getting the most efficient prop for their particular airplane.

We've been able to accomplish this by roughing out a prop - having them test it for performance data - refining and finishing it up from those figures. It takes a little more time and effort, but the results seem to make it worth it.

We have also developed and tested a new design for the Long-EZ with the standard O-235 engine and are really happy with the results. This new design is of a lower pitch, wider tip, and a new blade angle which has raised the static rpm and still maintains top-end performances. We have also changed the tips on our propellers which has reduced the noise level considerably.

We offer the props in either the five-laminate or multi-laminate. Both are made of maple, and both perform basically the same. We personally prefer the five-laminate because it tends to flex a little more and helps the take-off performance somewhat. However, the multi-laminate are beautiful, so it is mostly just a builder preference. A note we would like to emphasize is that although the multi-laminate does hold torque a little better due to all the glue, it is still absolutely necessary to check your prop on a periodic basis. Periodic checks and maintenance of your propeller is just good common sense no matter if it's five or multi-laminate.

Our props are all manufactured with the rubber leading edge which has proven so effective against rain erosion damage. We ship props worldwide, and have been certified in Australia, England, Canada, etc., for many years.

By the way, that yellow streak, alias Earl Wilson's Yellow EZ - Tuff, that has won the Jackpot, Nevada unlimited race both years that it's run (1983 & 1985) is propelled by a B & T.

We are still thoroughly enjoying our travels and adventures in our "Vari-Long" and look forward to the '86 flying season and seeing all the great "canard" people.

Bruce & Bonnie Tifft"

Ocean No. 1644 Flexibilized - Intumescent Fireproof Coating Compound, a remarkable heat protection paint for use on firewalls, wing roots and engine cowling areas, is available from:

Wicks Aircraft
410 Pine St.
Highland, IL 62249
618-654-7447

Bill Bainbridge of B&C Specialty has completed a two year development program on a lightweight starter for Lycoming O-235 through O-360's. This starter weighs 10.2 lbs and is about 8 lbs lighter than a geared Prestolite starter or about 6 1/2 to 7 lbs. lighter than a standard starter such as found on an O-235 or O-320. Fred Keller has installed two of Bill's new starters on his Defiant and he is very pleased. They crank the engines better in cold weather than the standard starters do,

and he saved about 14 lbs. Bill will have his new starters at Oshkosh '86. Of course, Bill still offers a full line of lightweight alternators well suited to EZ's as well as his really high quality linear voltage regulator which is highly recommended if you intend to install a Loran-C.

Contact: Bill Bainbridge
B&C Specialty Products
518 Sunnyside Ct.
Newton, KS 67114
316-283-8662

VISTA AVIATION
Whiteman Airport
818-896-6442

Dusty Rhodes and Brenda own and operate this small but neat avionics-type store. Dusty is an authorized King dealer and carries a variety of avionics including ARNAV, Apollo, and Northstar Loran-C's. They also have a number of other items of interest to homebuilders, and in almost every case, the price is very competitive. The store is located on the Whiteman Airport and you can taxi up to the door.

Dusty built a very nice VariEze back in 1978 and is knowledgeable on homebuilts. He has been doing quite a lot of installations of radios and various avionics in homebuilts and can pre-wire an entire radio stack for you to meet your requirements.

Give Vista Aviation a try, we are very glad we did.

LIGHTWEIGHT ALTERNATORS FOR LYCOMING ENGINES.
Made by Pelican Aviation of Costa Mesa, CA and sold by Aircraft Spruce of Fullerton, CA, these alternators come in 35amp (4-3/4" dia, 7 lbs) or 55amp (5-1/2" dia., 9 lbs). The alternator brackets are machined from solid aluminum and are anodized and stressed for aerobatics. Both are available in 12 volts or 24 volts.

Contact: Aircraft Spruce
Box 424
Fullerton, CA 92632
914-870-7551

CORRECTION TO CP48
Aerox Oxygen Systems phone number was incorrectly printed. It should be 800-237-6902 not 6702 as printed in CP48.

FOR SALE
Marvel Schebler carburetor MA-3A, part # 10-3103-1, $280.00. Write to:
Jim Cord
16525 E. Whittier Blvd.
Whittier, CA 90603

Lycoming O-235-C2C, 115 HP. 1535 hrs. total since new. Includes all accessories plus new mags. $3500.00 or will include Long-EZ engine mount, B&T prop, spinner & prop extension for $3800.00. Call: Mac, 213-834-8850.

B&T prop 62x66 - $150.00

Spinner for above - $50.00
6" prop extension - $125.00
Call: George, 213-596-3051

HELP!
Do you have a successful working ADF in your plastic airplane? Squadrons I and II in southern California are very interested in such an installation. If you have, or know of a good method of installation with an antenna that will allow nominal range, write or call: Joe Heapy,

8561 Fairmount Cr,
Westminster, CA 92683
714-895-7943

CAUTION - PROP BOLT OVER-TORQUING
We continue to hear of various abuses being committed on prop bolts - the latest is over-torquing! A standard O-235 uses 3/8"x24 (AN6) bolts. The recommended limits for these bolts is 225 in/lbs (minimum) and 300 in/lbs (maximum). If you over-torque this size bolt to 400 or 450 in/lbs, you will fail the bolts at the threads. The recommended torque value is 200 to 250 in/lbs (18-21 ft/lbs) for the 5-laminate wood props or as much as a maximum of 300 in/lbs (25 ft/lbs) for the newer, multi-laminate wood props. A quality thread lubricant should be used on prop bolt threads. A 50/50 mix of 50 weight engine oil and STP is also good.

BE CAREFUL AND CONSCIENTIOUS ABOUT PROP BOLTS - THE LOSS OF A PROP CAN BE POTENTIALLY LETHAL.

CAUTION
We heard from a builder the other day who was preparing to build his centersection spar and was planning to substitute blue styrofoam (wing foam) for the urethane! This is an absolute NO-NO. The centersection spar box is the aft wall of the fuel tanks and one tiny pinhole leak in the glass facing would allow fuel to permeate into the styrofoam which would then dissolve. Once the foam, which supports the glass spar caps was gone, the spar would fail. Don't even think about substituting styrofoam anywhere where it may come in contact with fuel.

If it ever crosses your mind to do so, do yourself a favor and pour a little gasoline onto a styrofoam scrap and watch what happens!! PVC foam and urethane foams are not affected by fuel.

CAUTION
If someone plays with your rudder, or even if the wind blows your rudder forward, in some cases it may be possible to get the rudder cable snagged inside the cowling. This is especially the case on the left side where most of us have our oil cooler. We know of at least two instances where this did, indeed, occur, and it really does make for an interesting landing technique. Remove the top cowl and have someone move the rudder back and forth and carefully evaluate the chances of this happening. If it can, it will! Install a guard or shield to prevent this possibility and be absolutely certain that your guard does not make the situation worse! Thoroughly test your installation before installing the top cowling.

CAUTION

On a Marvel Schebler carburetor equipped with an accelerator pump, there is a small "half moon" shaped bowl held on with two screws. Byron McKean reported that while he was inspecting his carburetor float bowl, which had absolutely nothing in it, he removed this little cover under the accelerator pump and found it literally packed with sediment. It had not caused any problems at that point, but obviously it is something to watch for during inspections.

ACCIDENTS

The CP newsletter reports accidents and discusses their conditions and causes for information purposes for all operators. We have always investigated accidents in the interest of determining information that we can disseminate to you, the builders, to help prevent reoccurrence. It should be recognized in our discussion of accident conditions or causes that generally this information is preliminary, since it is published before the availability of the FAA or NTSB accident report.

A Long-EZ in Illinois landed in a row of trees after the engine quit. The pilot was on a 1/2 mile final at 300 feet at idle power due to another plane in front of him. When he added power, the engine quit. Two attempts were made to start the engine using the electric starter, to no avail. He hit a small electric wire, then landed in a row of trees planted as a wind break. The canard broke on both sides, the right wing broke at 1/2 span, the left wing was damaged near the strake. The main gear was still attached but bent aft. The left wheel/axle was sheared off breaking all four bolts. The pilot received a small cut on his hand and that was all. No cause for the engine quitting has been determined. The first thing that comes to mind, of course, is the engine idle speed. This may or may not have had

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anything to do with this accident, but we have seen airplanes set up with such low idle speeds that they do have a tendency to quit on short final. However, that is normally an occurrence in the flare where it is only an annoyance as far as taxiing after the landing. An excessively high idle RPM is not satisfactory in that it makes it tough to land an airplane with the L/D of a Long-EZ. In general, if your engine will idle OK on the ground, it will idle even easier at approach due to inflow assisting the propeller.

* These values are probably incorrect as a Long-EZ can easily glide 1/2 mile from 300 feet while decelerating 10 knots.

A Northern Nevada VariViggen was involved in a first flight, take-off accident. The airplane was demolished but the pilot suffered only minor cuts and bruises. Unfortunately, this accident could easily have been avoided. The pilot had no current medical or biennal, nor had he flown at all in the past 3 years. He did not inform the FAA of his intention to fly and he attempted to take-off on an uphill runway with a tail wind.

A California VariEze crashed on final approach. The pilot was seriously injured and the airplane was badly damaged. His approach was at a busy flyin with a lot of airplanes on final. He got gown too low and far too slow. Eyewitnesses saw the airplane very low with wing

rock. The airplane caught a wing on the approach light system, 800 feet short of the runway and 15 feet above the ground. The airplane cartwheeled and hit upside down and slid to a stop 300 feet short of the runway. The moral here is "never be too proud to execute a go-around, no matter how much pressure there is to land."

A Long-EZ on its first flight after installing a newly overhauled engine suffered an inflight engine fire and was unable to make it back to the runway. The engine quit on approach and the pilot attempted to land in a housing tract. There was not enough room and he rolled into a car which also burst into flames. He landed under control, thus, inflight structural failure or control failure are not suspect. Sadly, the pilot was killed by fire. The fire was so intense in the engine/cowling area the the FAA accident investigator was unable to determine what could have started the fire. The fuel pumps, carburetor, etc., were consumed. The airplane had been airborne for only a few minutes. Reportedly, the engine was an 0-320 and he was using auto fuel. We may never know what caused the fire, but it is easy to overlook a loose fitting - we have done it ourselves. A fuel leak, particularly auto fuel, could be ignited by hot exhaust or any number of things. Always try to have at least one other person go over your work, especially engine related work like plumbing or control systems. The more pairs of eyes that look at your engine installation, the better chance that you will catch some overlooked items. This is specifically important if you are developing new, unapproved installations.

Never, ever, cowl an engine that has been worked on without a brief engine run to check for leaks. We, here at RAF, have more that once found fairly drastic leaks during the leak-check engine run.

FIREWALLS AND FIRE PROTECTION OF FLIGHT CONTROLS

The study of VariEze accident history has always shown considerably reduced incidents of fire as a result of an accident than the conventional metal aircraft with the engine on the front. The reasons for this are relatively obvious in that the sources of ignition of the fire are more remote to the major impact. Another feature that has been considered safer than the tractor aircraft is the airflow pattern through the engine area which pulls the fire away from the aircraft rather than impinging it toward the firewall. There have been no accidents or incidents in the VariEze or Long-EZ that have been caused by fire destroying aircraft structure or flight controls. There may be, however, a possibility of this occurring and this possibility is something that we feel obligated to address and, thus, are recommending specific modifications to the VariEze, Defiant and Long-EZ to reduce, as much as possible, the exposure to this risk.

Several years ago, we tested a product called Liquid Firewall and found it did not provide satisfactory fireproofing/insulation and, thus, did not recommend its use and, in fact, specifically cautioned those who would attempt substituting it for the recommended firewall. A couple of weeks ago, Wicks Aircraft sent us a new product (Ocean 1644 Intumescent) to evaluate. This material is intumescent which means it swells up to a very thick layer of high temperature insulation and provides surprising results in that it will protect an aluminum surface from fire damage for a considerable time period. We do not have the equipment to specifically qualify this material to FAR 23 regulations,

however the torch tests we have conducted have convinced us that it can provide a considerable barrier to deterioration by fire to aluminum or composite structure. The other good news is that this material costs considerably less than the previous liquid protection product.

Because of our concern that it may be possible to suffer unacceptable structural damage or loss of flight controls, we are recommending mandatory changes in this newsletter to all our designs except the Solitaire. This is particularly important in the VariEze and Long-EZ where both yaw and roll systems pass through the engine compartment. Loss of roll control on a Defiant may allow recovery using rudder.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

VARIEZE PLANS CHANGES

MAN-GRD
Modify the roll and yaw control systems between the firewall and the wing roots by substituting 4130 steel or any stainless steel for all aluminum components with thicknesses less than 0.1 inches. This includes tubes, pushrods (with inserts), pulley brackets and bellcrank brackets. Apply Ocean No. 1644 Flexibilized - Intumescent Fireproof Coating Compound to the aft face of the centersection spar including interior flange surfaces between the existing firewall and the wing

root rib. If your Fiberfrax shield is aluminum rather than the stainless steel option, coat its aft surface with Ocean 1644 Intumescent. Inspect

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all fuel system plumbing and fuel system components for approved fireproof components. Substitute approved fireproof components (steel or stainless) for any aluminum components and be sure that fireproof sleeves are used on all hose components. Any exposed aluminum tubing or fittings should be corrected with approved stainless steel or steel aircraft fitting. If your gasolator bowl is aluminum, wrap it with approved fire sleeve material similar to the hose sleeves.

LONG-EZ PLANS CHANGES

LPC #130 MAN-GRD Add to owners manual page 16. "Clear" idling engine every 15 seconds or so on the approach. Also, always fly final with the speed brake and at an altitude to allow reaching the runway without the engine after retracting the speed brake. Accounting for deceleration to the stall speed, this can be done from a 3 degree flight path at 1/2 mile final.

LPC #131 MAN-GRD Modify the roll and yaw control systems between the firewall and the aluminum protective ribs at the wing roots by substituting 4130 steel or any stainless steel for all aluminum components with thicknesses less than 0.1 inches. This includes tubes, pushrods (with inserts), pulley brackets and bellcrank brackets. Apply Ocean No.1644 Flexibilized - Intumescent Fireproof Coating Compound to the engine-side surface of the aluminum wing root shield ribs. Apply Ocean 1644 Intumescent to the aft surface of the centersection spar including interior flange surfaces between the existing firewall and the wing root rib. If your Fiberfrax shield is aluminum rather than the stainless steel option, coat its aft surface with Ocean 1644 Intumescent. Inspect all fuel system plumbing and fuel system components for approved fireproof components. Substitute approved fireproof components (steel or stainless) for any aluminum components and be sure that fireproof sleeves are used on all hose components. Any exposed aluminum tubing or fittings should be corrected with approved stainless steel or steel aircraft fitting. If your gascolator bowl is aluminum, wrap it with approved fire sleeve material similar to the hose sleeves.

DEFIANT PLANS CHANGES

DPC #39, MAN-GRD
Section 1, page D-40, Rudder pedal/brake assembly. Outboard mount, RUD-7 should be mounted per the sketch below. Do not fly your Defiant with the RUD-7 bracket mounted to the floor per page D-40 - it is possible, under heavy steering or braking forces that the AN525-10R8 screws can pull through the floor. Also, see sketch below for additional stiffening required under the master cylinder brackets - use 1/4 birch plywood as shown. **SKETCHES OMITTED**

DPC #40, MAN-GRD

Before next flight, inspect two rigging areas for nose gear (1) steering pivot vertical to tolerance, 2 degrees bottom forward to 1 degree bottom aft, (2) "trail" of axle relative to pivot axis. See elsewhere this newsletter.

DPC #41, MAN-GRD
Modify the roll and yaw control systems between the firewall and the wing roots by substituting 4130 steel or any stainless steel for all aluminum components with thicknesses less than 0.1 inches. This includes tubes, pushrods (with inserts), pulley brackets and bellcrank brackets. Apply Ocean No. 1644 Flexibilized - Intumescent Fireproof Coating Compound to the aft face of the centersection spar including interior flange surfaces between the existing firewall and the wing root rib. If your Fiberfrax shield is aluminum rather than the stainless steel option, coat its aft surface with Ocean 1644 Intumescent. Unlike the Long-EZ, the Defiant does not have the aluminum wing root shields. These areas are covered by the cowling which continues though the wing root area. Coat the interior face of the cowling with Ocean 1644 Intumescent extending 2" above and below the wing. Inspect all fuel system plumbing and fuel system components for approved fireproof components. Substitute approved fireproof components (steel or stainless steel) for any aluminum components and be sure that fireproof sleeves are used on all hose components. Any exposed aluminum tubing or fittings should be corrected with approved stainless steel or steel aircraft fittings. If your gascolator bowl is aluminum, wrap it with approved fire sleeve material similar to the hose sleeves.

DEFIANT ENGINE PLANS

At last the Engine plans for the Defiant are ready. We have these in stock and the cost is $54.50. The plans consist of an 11 x 17 book and 14 blue print pages, 24 x 36.

BUILDER HINTS
PVC foam, Divinycel or Klegecel can be joined with micro at any time. For example, for the bulkheads, NG-30's F-22, F-28, etc., if your PVC foam is too small, you can micro pieces together in order to make the piece large enough to cut a bulkhead out of. The micro joint is stronger than the foam itself and, therefore, this technique can be used anywhere. The only disadvantage is, of course, that the more micro joints you have, the heavier the part and, therefore, the airplane will be.

LANDING LIGHTS
Mike and Sally's Long-EZ has a 28 volt system and for the past 5 years, they have flown over 1130 hours including approximately 100 hours at night. They have always used a GE sealed beam, #4594 (100 watt, 28 volt) landing light, and Mike has always wished for more light. This would, obviously, be very beneficial in the event of a forced landing at night. Finally, a few weeks ago while visiting Dusty and Brenda's airplane parts store, Vista Aviation, on the Whiteman Airport, there it was, a 28 volt, 250 watt, par 36 landing light! He purchased and installed it immediately and reports a huge improvement. For those of you who have 14 bolt systems, Dusty has 14 volt, 250 watt, par 36 landing light sealed beam units. In fact, he has the whole range:
Part #4509-14 volt, 100 watt

Part #4313-14 volt, 250 watt (requires 25amp C/B)
Part #4594-28 volt, 100 watt
Part #4596-28 volt, 250 watt (requires 15amp C/B)

See VISTA AVIATION under "Shopping"

LONG-EZ BRAKES

Those of us who have heavy Long-EZs have known for a long time that the standard Cleveland 500 x 5 brakes were somewhat marginal. At best, they eat up brake pads at the rate of a set every 25 hours! Over a year ago, Mike Melvill obtained a heavy duty set of brakes from "Flying Magazine" journalist Peter Garrison. Peter designed and built the Melmoth, an ultra long range airplane which he flew across the Atlantic as well as the Pacific. Melmoth weighed over 3,000 lbs. at gross weight, yet it used 500 x 5 wheels.

Peter obtained a special set of brakes from Cleveland which was working with the Italian company, Caproni, to develop a heavy duty brake for Caproni's jet trainer. These brakes consisted of a stock 500 x 5 disc, except it was almost 3/8" thick. The caliper was from a 600 x 6 brake.

Peter Garrison put over 2,000 hours on his Melmoth before it was destroyed in a freak accident. He gave the brakes to Mike and Sally and they have flown them now for over 300 hours.

Mike reports that these brakes are over 60 percent more effective than the standard brake and do not use up brake linings. He finally replaced the linings after 250 hours and they really weren't all that worn!! Of course, RAF has been attempting to find out if Cleveland could provide these brakes for Long-EZ builders, but with no luck. Dick Kriedel of Squadron 1 in Los Angeles tried even harder and finally got them to special-build him a set of the thick discs. Apparently the right hand does not talk to the left hand at Cleveland because Tom McNeilly, an experienced builder from the Phoenix, Arizona area, who has built two beautiful Long-EZs, has managed to discover that Cleveland does, indeed, manufacture these brakes and that they are, in fact, still available. We sure appreciate Tom's efforts, for these brakes really do fix the one weak point on the Long-EZ (particularly a heavy one!) and we certainly recommend them. Tom has installed them on two Long-EZs so far and reports a dramatic improvement in braking effectiveness. He feels the safety benefits are well worth the money.

Tom obtained his brakes through: Varga Enterprises
2350 S. Airport Blvd.
Chandler, AZ 85249
(602)963-6936

Talk to George Varga. The part numbers are:
Caliper Assembly 30-133.
Heavy Duty Disc 164-85.
Total cost is around $400.00 The installation is simple. The caliper assembly slips right on to your existing 500 x 5 brake plate and the disc is a direct bolt-on replacement. The thicker discs can absorb much more energy and the 30-133 caliper assembly has a piston in it

that has almost twice the area (2" diameter versus 1.5" diameter) of the standard 500 x 5.

Keep in mind that this more powerful brake will generate more heat! Fiberfrax protection for the gear strut is even more important. If your disc is too close to the strut, consider installing a 1/4" thick aluminum spacer between the axle flange and the gear leg. Ventilate the top of the wheel pants by cutting a hole at the highest point in the wheel pant when the airplane is parked nose down. This will allow a chimney effect to cool hot brakes after you stop when there would not normally be any flow through the wheel pants. For new installation, it is even more important to remove your wheel pants before conducting any taxi testing!!

Now that he has good brakes, Mike has noticed that the additional heat generated is even harder on the nylon brake lines and even though he has carefully insulated them, the heat transfer from the brass elbow seems to cause the nylon close to the brass elbow to become brittle and to cause a small hydraulic oil leak at the fitting. Since his experience of a brake fire in the Defiant, he is very suspicious of small leaks and has been inspecting these fittings frequently. His conclusion has been that he is going to change the brake lines from nylon to stainless braided teflon high pressure brake lines. This is a big step but he feels it is worth it. While he is at it, he is going to drain the aircraft grade brake fluid which is flammable and carefully flush the system with 100 percent denatured alcohol. Then he will use automotive DOT 5 100 percent silicone brake fluid. The main advantages are that the silicone fluid is not flammable and is completely inert and therefore does not effect O-rings or rubber seals. There are a number of EZ flyers already using this brake fluid with perfect results. The Antique Aircraft builders have used it for years because it does not effect their dope and fabric airplanes!

We can talk more about this at Oshkosh.

FUEL LEAKS IN THE ENGINE COMPARTMENT

We recently heard from a Long-EZ pilot who had just installed new fuel lines in his airplane. While on a cross country flight, he noticed that his cylinder head temperatures were way down from where they normally ran, and they continued to run cool for the duration of the flight. Upon landing, he removed the bottom cowling and found that the engine looked as though it has been steam cleaned! He turned on the boost pump and a fine mist of fuel sprayed out of one of the new fuel lines. These were stainless braided fuel lines, supposedly aircraft quality, and yet, one of them had several tiny pinhole leaks that had allowed a fine spray of AV gas to drench the engine. Apparently, the high speed cooling air, mixed with fuel, had literally scoured the engine clean as a whistle! Why no fire? Perhaps it is the relatively high flash point of AV gas which is much higher than auto gas. According to Popular Science, March 1986, it is becoming increasingly commonplace to boost octane ratings by dissolving cheap "light ends" such as butane into auto fuel. This increases vapor pressure and volatility and lowers the flash point. If this Long-EZ pilot had been using auto fuel, he may not have been so lucky. See "Accidents" in this issue.

Fuel leaks aft of the firewall are potential killers. If you have recently broken your fuel lines, or if you are in a new, untried installation, it is mandatory that you conduct a short engine run with the cowling removed.

Carefully inspect all the lines and fittings for leaks (including oil leaks) while the engine is running (watch out for the prop!) and fuel and oil is under pressure. It is common to find one or more fitting loose and you would be surprised how much oil you can lose through a finger tight (but not correctly tightened with a wrench) oil line nut.

Some years ago, Dick Rutan had a fuel line fitting break in flight during a speed record attempt. He lost most of his fuel over board before he became aware of the problem. When he landed, the entire aft end of the cowling and wings were stained with 100LL blue stain. This was the result of mounting an electric fuel pressure sender directly to the carburetor. The vibration failed the aluminum fitting. It is very important that fuel pressure and oil pressure senders be remotely mounted with flexible, aircraft quality hoses connecting them to the engine.

Use only steel elbows, nuts and nipples aft of the firewall in the fuel system. In certified aircraft, only steel or stainless steel fittings and tubes are used between the firewall and the engine, and all fuel and all oil flexible hoses have fire sleeves covering them. The reason is that in the event of an engine fire, the fuel and oil system will not burn through, thus allowing the pilot enough time to execute an emergency landing. Other than an inflight structural failure, an inflight fire would have to be the scariest thing that could happen to a pilot. As the builder of your own airplane, you owe it to yourself to do the best possible job you can on your engine/fuel/oil system. If in doubt, have an A&P or AI mechanic look it over. At least, have other EZ builders look at your engine installation. Many times, in spite of our best efforts, we miss something important which may be easily spotted by someone not so close to the project.

DEFIANT NOSE GEAR

The Mooney nose gear on the Defiant has caused several problems. On Burt's prototype, N78RA, he flew the first hundred hours with no shimmy damper. Several times, he experienced mild nose wheel shimmy, and once, heavy nose wheel shimmy. Mooney provided a rebuild-kit for the nose gear which helped a lot since all new bushings tightened the whole assembly. This did not fully cure the nose wheel shimmy problem however and, ultimately, we had to install a shimmy damper.

Unfortunately, it is not a readily available part. We converted a double acting hydraulic cylinder we found in a junk yard and it has worked flawlessly ever since.

Fred Keller also has installed a hydraulic shimmy damper in his Defiant. It works very well, but once again, it is something Fred found in a salvage yard, and it has no markings or part numbers on it.

We believe you should install a shimmy damper in the Defiant nose gear steering system, or sooner or later you will experience nose wheel shimmy. Any commonly available shimmy damper, such as can be found on

a Cessna 150 or any Cessna, Piper or Beech for that matter. The one on a Beech Duchess is an excellent unit, it is small and should be relatively easy to mount. The main thing is to build a strong mounting point that is stiff and does not have any play in it.

We have noticed on several of the new Defiants that are now flying, that the nose gear does not appear to go all the way down and forward the way it should and does on Burt's and Fred's airplanes. One problem here may be that the firewall was not correctly notched away to clear the nose gear weldment. You will have to cut away approximately a 1" x 8" notch in order that the nose gear can go all the way down into the correct position and that it will clear the firewall at full steering lock, both left and right. Probably the most important dimension of all is the distance between the nose gear retract pivot at F.S. 25 and W.L. 50.5 and the retract arms main pivot at F.S. 64.5 and W.L. 37.0. The linear distance between these points is 18.44, and this dimension must be held as closely as possible, even if you are slightly off on the actual pivot points. The 18.44" dimension is "golden". **SKETCH OMITTED**

In CP 47, Page 4, we've reprinted a Mooney service bulletin on checking the "trail" of the nose gear. Unfortunately, we misprinted the important dimension! The 0.6 dimension shown in CP 47 is not correct. This dimension should be .06. Do not set your nose gear geometry using the CP 47 dimension.

If you do, unsafe oversteering tendencies will result during high speed taxi. The plumb bob will indicate properly only if you jack the airplane to a position in which the steering pivot axis is exactly vertical. Mooney recommends installing the 20-202-3 spacer if the position of the axle is forward of the .06 dimension. No guidance is given on what to do if the dimension is too far aft. Our experience has shown that aft trail is susceptible to shimmy. Thus, we recommend adjustment to as close to the 0.06 dimension (forward) as possible. Note that this results in the axle being well forward of the steering axis due to the plumb line laying over the forward side of the trunion tube. For further information, refer to Mooney service bulletin M20-202 Mooney, Kerrville, TX 78028.

Keep in mind that the "vertical" steering pivot should be essentially vertical to very slightly top aft, when the aircraft's waterline is level. Take great pains to get the geometry correct and your nose gear will operate smoothly and should give years of trouble free service.

When you set up your linkage between the nose rudder, the nose gear steering and the rudder pedals, you should center the nose gear. Then set the rudder so it is parallel to the fuselage centerline. Now clamp the rudder pedals in an even position. Install the linkage and lock them to retain this relationship between rudder pedals, nose gear and rudder. Jack the nose wheel off the ground and check that the full travel of the nose gear does not interfere with anything, especially the firewall. Get someone to apply a light aft load on the nose gear and retract it and extend it a few times. This check is to ensure that the mechanism does not interfere with anything under, and in front of, the instrument panel. Recently we installed a Loran-C into Burt's Defiant and neglected to perform this test. Needless to say, we were unable to retract the nose wheel! Be careful.

NOSE TIE DOWN
It can be difficult, even impossible, to remove the nose gear strut due to the AN5 pivot bolt having to go through the side of the nose. This problem can easily be solved and you get a good nose tie down into the bargain! **SKETCH OMITTED**

By removing the AN3 cross bolt from the aluminum tube, you can reach the head of the AN5 nose gear pivot bolt using a socket on an extension, and the bolt can be withdrawn through the aluminum tube allowing periodic inspection of the nose gear pivot.

CONTROL GUST LOCKS
Control locks on the ailerons and rudders can prevent damage to the control system and to the winglets when the rudders are blown forward allowing the rudder belhorn to gouge the paint. A nice, simple gust lock can be made up using a few pieces of .032 aluminum and some short lengths of aluminum angle. See sketch. **SKETCH OMITTED**

A little weatherstrip rubber can be stuck to the face of the angles to help the gust lock remain tightly in place and to prevent damage to the painted surfaces.

Other gust locks we have seen include simple duct tape (red is best since it is easy to see) and large spring clips with rubber glued to the jaws. A long, red ribbon would help prevent accidentally leaving them on. Which brings up the question of safety. Down through the years, there are many, many instances of accidents caused by leaving gust locks in place. A thorough preflight should eliminate this possibility. The elevators really don't need gust locks, just set the bungee trim to hold the elevator in the faired position and always try to park the EZ nose down facing into the prevailing wind.

CANOPY GAS SPRING FOR THE DEFIANT

Roger Rupp (907-262-9265) from Soldatna, Alaska, is building a Defiant and, after much research, came up with a source for the proper gas spring.

Gas Spring Company
92 County Line Rd.
Colmar, PA 18915-9607
215-822-1982
Order a: Prototype, non-auto
FB22A (P1-60)

This gas spring is approximately 36-1/4" long and Roger's installation works very nicely. (See sketch) **SKETCH OMITTED**

Note: This gas spring has 60 psi in it, and this means you must take care to very thoroughly secure the cross tube to the sides of the canopy, or the 60 psi will eventually work the cross tube loose, especially from the right side. Contact Roger if you would like to discuss his installation.

EPOXY BRUSHES
Yet another method to get the most out of your brushes. Rinse the brush in acetone, wrap it still wet with acetone in a folded paper

towel. Put the brush in a plastic sandwich bag and wrap it with a rubber band to hold the paper towel against the bristles. As the brush dries, the paper towel leeches out the epoxy/acetone leaving a clean reusable brush, Don't be discouraged by the stiff paper towel, just peel it off and press on the bristles to restore the bristles to good shape.

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TUESDAY, 15TH JUNE, 6:36AM PDT
FLASH!
As we go to press, Dick and Jeana have successfully completed their flight up and down the California Coast. They have set a "provisional" closed course distance record of approximately 10,074 nautical miles (11,600 statute miles) in 110 plus hours of flight. "Provisional" because it has not been officially ratified at this time. The flight was essentially flawless. The pilots were in excellent shape when they climbed out of the airplane and they are pleased with the results. After landing, the Voyager was carefully weighed and it had, in fact, enough fuel on board to have gone on to New York with fuel to spare!! An outstanding job well done.

PHOTO CAPTION
"Coming Home" - Dick and Jeana in the Voyager over Tehachapi on her way to a triumphant reception at Mojave after flying more than 10,000 nautical miles, non stop, non refueled, over a four day, five night flight. Bruce Evans flies chase in a Sierra, while Burt and Mike fly the left wing in a Duchess. Photo by Mark Greenberg.

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THE CANARD PUSHER NO 50 OCT 86

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 50. If you are building from 2nd Edition plans you must have newsletters 18 through 50. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 50. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 50. If you are building a Long-EZ you must have newsletters from 24 through 50. If you are building a Solitaire, you must have newsletters from 37 through 50. If you are building a Defiant, you must have newsletters 41 through 50.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

OSHKOSH '86
Burt flew his Defiant, N78RA, and Mike and Sally flew their Long-EZ, N26MS, into Oshkosh again this year and this year saw more Rutan Designs on the flight line than ever before.

Irene "Mom" Rutan did her usual sterling job of checking everyone in and chasing down all elusive ones parked in camping areas, etc.. Once again, not everyone registered, so her count does not jive with the number published in the Sport Aviation. It really is hard to understand why you guys and gals don't register, a few minutes of your time, and that is all - maybe next year? According to Irene, there were 54 VariEze's, 67 Long-EZ's, 3 Defiants and 3 VariViggens that were parked on the ground at Oshkosh in 1986. That is a grand total of 127! A list of all "N" numbers recorded by Irene and seen by her on the field is published in this CP.

The RAF booth was shared this year by Feather Lite Products (Larry Lombard and Michael Dilley) and the IVHC. This made for a much more interesting booth with all kinds of hospitality club members helping out, the booth was always crowded, friendly and happy. Larry and Michael had several of their products there for builders to inspect and it was really neat having them there to help answer questions.

We are very proud of "our" EZ builder/flyers who keep showing the way with some truly outstanding workmanship, and who continue to blow away the rest of the field with the kinds of incredible trips routinely flown all over these United States as well as many, many parts of the world. A recent example is two Long-EZ's which flew from Spokane, Washington to Australia, crossing the Atlantic via the Azores, (not to be confused with the more normal island hopping route via Greenland, Iceland and Scotland which can easily be accomplished even in a Cessna 172).

Pretty incredible, really. As we said, we are proud to be associated with these kinds of people.

Some highlights for us at this year's Oshkosh were the obvious effort that EAA had made on the flight line, the Homebuilders Corner, a neat little building on the flightline used one morning by the EZ group, good coffee, good company and lots of "hanger flying". The Italians were sensational! The Goodyear blimp was ponderous, but interesting. The Pitcairn Autogiro was quaint! The little Stratos from Australia was cute. Best of all, the Hospitality Club dinner, as always was really the highlight of the week. Thanks to Bernadette and Doc Shupe.

A poll was taken at the Bull Sessions of rain trim changes in VariEze's, Long-EZ's and Defiants. The VariEze's had 9 examples that trimmed nose up and 12 that trimmed nose down in rain. The Long-EZ contingent had 16 that trimmed nose down and 1 with no trim change, all standard canards. Three examples of the Roncz canard were there and all 3 had no trim change. All three Defiants reported no trim change. The trim change in the EZ's range from very slight to slight (90 percent), or moderate (5 percent), heavy (5 percent). It was very difficult to see or feel any difference between these canards.

If you did not make it this year, too bad, how about next year? Don't forget to register!

"Dear RAF People;

I am quite sure I have "N" numbers of all the Oshkosh arrivals. I also checked at the registration booth, thanks to all who registered, it helped an awful lot, it seems like I did little else at Oshkosh this year! If I have missed anyone, please write and tell me.

I enjoyed meeting all of you and seeing the great quality of the Rutan Canards on the field. Thank you for your support of the Voyager program, you are a great group!

Thanks,
Irene"Mom" Rutan

P.S. I wish I had the names to go with all these "N" numbers."

VARIEZE'S

F-PHYZ	N1335D	N89RS	N83RP	N13WM	N83RH
N3252	N4ZZ	N15PR	N83DE	N82VE	N3793X
N44GG	N39EZ	N28JF	N93QL	N19VE	N235LB
N288EZ	N57EZ	N26JW	N60SD	N36SD	N267WM
N2286A	N37EZ	N67EZ	N86DH	N87JD	N12VE
N9091A	N28RR	N82JF	N8301	N118SJ	N49VE
N301RW	N300DJ	N222HK	N222EG	N16EL	N99VE
N7AH	N1QD	N729BB	N3976D	N79SG	N18VL
N718RM	N999JD	N9113A	N110NA	N99RS	N3262D

LONG-EZ'S

N112DC	N25LE	N339E	N412DM	N34JR	N112TG
N115EZ	N460LZ	N26MS	N10NG	N454BC	N85LD
N339E	N211LE	N30EZ	N100RY	N97EZ	N350JK
N61MB	N63DW	N35VL	N345KJ	N25HC	N988ST
N78CD	N888EZ	C-CBLD	N510PG	N84LL	N85LD
N676H	N1378X	N44TJ	N407MN	N84DY	N40EB
N39A	N68BW	N606TT	N45FC	N31JJ	N101AN
N684SK	N369R	N494LE	N84HT	N169SH	N86LM
N252BC	N46AA	N67KC	N44FC	N81HM	N410BB
N412DM	N8EZ	N45EZ	N2069G	N38AR	N100PY
N883MB	N38EZ	N442C	N360DP		

DEFIANTS

N78RA
N39199
N38JM

VARIVIGGENS

N873L
N33VV
N31WV

N4ZZ, VariEze built and flown by Ken Swain has been on the flight line at Oshkosh 8 years straight!

The Designer's Award, this year, went to STEVE WRIGHT of Brentwood, Tennessee for his outstanding example of a VariEze, N9091A. Congratulations, Steve!

VOYAGER UPDATE
As most of you will know by now, the Voyager has suffered a serious setback in its schedule. Things were going very well. A full dress rehearsal for world flight take-off was successfully flown out of Edwards Air Force Base at the heaviest weight flown to date.

This flight brought out a few points that required one or two more engineering test flights before a world flight could be attempted. During one of these flights, while flying level at 9,000 feet. a moderate cruise power setting, one blade of the front engine's propeller separated from the hub. The ensuing vibration was so intense that several instruments came out of the panel and the rear engine's spinner thrashed enough to run into the cowling. The front engine

mount broke in two places and every tube was bent. The engine remained on the airplane, fortunately. Both engines had safety cables attaching them to the firewalls. Dick's biggest problem was determining which engine was in trouble.

Obviously, he did not want to shut down the wrong engine! The chase plane was able to identify it for him and he subsequently caged the front engine, declared an emergency with Edwards and made a safe landing on their runway 40.

The Voyager was flown, single-engine, back to Mojave the next morning after substituting a good old reliable B and T wood prop for the variable pitch prop on the rear engine. The front prop, which had failed, was removed and sent away for inspection and evaluation. The manufacturer, as well as the prop shop that did the post mortem, think that some prop rework that had been done by the Voyager team in an effort to improve performance, may have contributed to the failure. It is also possible that the drying of the wood in the desert environment resulted in the loss of shank retention. We adjust for this with our fixed-pitch, wood props by routinely retorquing the bolts. This adjustment is not available on any of the variable pitch wood propeller types.

The Voyager team removed both engines. Beech provided transportation to Mobile, Alabama where Teledyne Continental began an immediate teardown/inspection and complete rebuild. Hartzell Propellers agreed to build up two special props using the latest John Roncz airfoil section blades. Bruce Evans and his team commenced to build a new front engine mount and to repair and modify cowlings to fit the new prop/spinners. Incredibly, this dynamic group will probably fly their next test flight by the end of October! An unbelievable feat in the face of overwhelming disappointment. The support that they have received from Continental, Hartzell and Beech is no less amazing - marvelous - Go for it, Voyager!

What can be learned from a problem like this? First of all, you can see why Burt has been so adamant about the use of variable speed/constant speed props on our experimental airplanes. To use any manufacturers variable or constant speed prop without conducting a full, in-flight, strain gauged vibration survey is probably courting disaster. Second, anyone who may still insist on doing some of this kind of testing should, at the very least, install a 3/16" diameter safety cable to retain the engine in the event of a failed engine mount - it could save your life. RAF categorically does not recommend any variable or constant speed props on any RAF designed airplane.

LONG-EZ'S TO AUSTRALIA

John Koch, N38TT, and Ed Roman, N38AJ, both stock 0-235 powered Long-EZ's, left from home base, Spokane, Washington. They flew non-stop to St. John, Newfoundland where they cleared customs and had their avionics checked and approved. The filed flight plans for the next leg, non-stop across the Atlantic to the Azore Islands, a distance of just over 1400 nautical miles (1611 statute miles), average fuel used for this leg was between 4.0 and 4.5 GPH. Each Long-EZ was equipped with a 36 gallon auxiliary tank in the back seat and each had Loran C as well as ADF. A good thing, too, because John's ADF went out and

Ed's Loran failed, between them, flying whenever possible as a flight of two, they were able to navigate well.

Several times, they were forced by local officials to take off separately which defeated the object of flying together for safety. In each case, though, they managed to find each other and join back up. Once, while penetrating a serious line of thunderstorms, John found himself being forced upward to be "spat" out of the top of an enormous storm cloud while Ed was blown out of the bottom. It took hundreds of miles for them to locate each other and join up after that experience!

They landed in some friendly and cooperative countries and also in some not-so-cooperative countries. In some cases they had great difficulty getting back out to their EZ's. Once in the terminal building, they could not get back out onto the ramp! After a really fantastic trip, they eventually arrived in Northern Australia where they left their Long-EZ's hangared with an Australian Long-EZ builder and returned home by "big aluminum bird" to earn more money and wait out the monsoon season. They intend to return to Australia next summer and continue their trip to Hong Kong, Hawaii and back to Spokane. John promised to write this up for a magazine article - should be most interesting. One piece of advice he feels could save anyone contemplating such a trip a lot of hassles - visit your local Navy surplus store and buy, at least, a Captain's jacket, complete with stars and bars and epaulets, and when in the East (Egypt, India, etc.) wear it, and it will get you through the barriers and gates you can't get through dressed in civilian clothes!

Anyone seriously interested in trying something like this trip may contact RAF for John's address. He says he can probably save you a lot of leg work and heartache.

Best of luck for the rest of the trip next year - please write a short blurb for the CP!

"THE BONNEVILLE 125"
Shirl and Diane Dickey have done it again! Another great fly-in and a super fast EZ race over the Bonneville Salt Flats. The weather made it rather tough to get to Wendover, Nevada, but quite a few made it and, in fact, the weather was not bad at Wendover.

The airport at Wendover is "big", a deserted old Air Force base, with nice long runways and it is an easy shuttle bus ride to the hotels. There are five or six nice casinos and several restaurants and lots to see and do. Wendover is a neat little Nevada town, almost on the border of Utah, even if it is situated in the middle of an area that looks for all the world like the surface of the moon!

The race was fast! Average race altitude was only 4500 feet. It was cool and the air was glass smooth. Only nine airplanes entered, so Shirl decided to run all 3 classes in one race. The winner of the unlimited race was a 200HP, retractable, Glasair with a constant speed prop. The surprising thing was that he only beat Dick Kreidel's Long-EZ with a tired 0-320, 160HP, fixed gear, fixed pitch prop, by a scant 4 MPH! Makes you wonder! Gus Sabo won the "standard" Long-EZ segment and Shirl Dickey won the standard VariEze race. Shirl turned in an amazing speed when you consider that he had a sudden power loss when

his number 3 piston partially seized. He pulled up thinking he was out of the race, went mixture rich, and the engine continued to run, so he "had at it" and finished a credible 6th overall. Here is a list of the pilots, their airplanes, class they competed in and their speeds:

Ken Ashby	Glasair	Unlimited	226.49 MPH
Dick Kreidel	Long-EZ	Unlimited	222.1 MPH
Earl Wilson	VariEze	Unlimited	219.65 MPH
Ed Kewey	Long-EZ	Unlimited	218.76 MPH
Wes Gardner	VariEze	Unlimited	214.98 MPH
Shirl Dickey	VariEze	Standard	204.14 MPH
Alan Dirkson	Long-EZ	Unlimited	194.16 MPH
Gus Sabo	Long-EZ	Standard	190.9 MPH
Stan Sneiderman	Long-EZ	Standard	174.16 MPH

LORAN UPDATE
Sally and I are continuing to build experience on our Northstar M1 Loran C. We are absolutely satisfied so far. On a trip to and from Oshkosh this August, we experienced no drop out at all! We had excellent, accurate data all the way there and all the way back. Our route was Loran-direct, essentially, Mojave - Las Vegas - Grand Junction, Colorado - Estes Park, Colorado - Sioux Falls, South Dakota - Oshkosh. We flew the entire flight at 17500', using our Aerox 02 system. We had 30+ knots of tailwind and the trip was smooth and uneventful.

Coming back was similar but with a 15-20 knot headwind. We flew at 8500' to 12500', and even when flying in rain, our Northstar continued to run flawlessly. A point that no one I know of, who uses a buried homemade antenna, can claim! Apparently rain causes a static buildup on the skin and the Loran will drop off the line. Just like all other Lorans we have tried, the Northstar becomes uncertain if we fly from Bullhead city, Arizona towards the southeast to Phoenix - or anywhere from there to the Texas coast. This, I guess, is a fact of life until the FAA installs one or two more Loran transmitters to eliminate the so-called mid-continent gap. In summary, we both love our Northstar. There is not one feature we would change if we could except, perhaps, to have it recommend the best restaurants at our destinations!

BOONVILLE, CA. UPDATE
Larry and Michael (Featherlite Products, Inc.) have been busy since Oshkosh where they shared the RAF booth and had on display a number of their products. They really enjoyed talking to so many of their customers and to be able to get out of their shop and talk airplanes for a whole week.

The Long-EZ leading edge fuel strake kit is now out and quite a few have already been installed. The leading edge "D" section is slightly oversize to enable you, the builder, to custom trim to perfectly fit the fuselage and wing. To identify the proper position, B.L. 23 rib must be located at the jink or bend, then you can trim to fit the fuselage, then the wing. Don't forget to remove the peel ply from the top and bottom lips before installing the flat panels.

After much scrutiny, Defiant cowlings are now on line. Cheeks have been enlarged to accommodate the O-320, as well at the O-360 Lycomings. The rear cowls will fit most prop/spinner combinations with little or no trimming required. The front cowlings may require some homebuilder "blending" for the various combinations of props, spinners and prop extensions.

Defiant wheel pants are under development and will soon be available. These are based on Fred Keller's beautiful Defiant's wheel pants.

Several builders have asked about removing mold release. After waxing, PVA (poly vinyl alcohol), a thin, green film, is applied to the molds. This film is water soluble, so use a wet sponge and lots of water to wash it off your parts. Allow parts to dry thoroughly before scuff sanding for finish.

For more information, contact Larry or Michael at:

Featherlite Products, Inc.
P.O. Box 781
13451 Airport Rd.
Boonville, CA 95415
(707)895-2718

DEFIANT NEWS

Charlie Gray flew his new Defiant, still in primer, 2 years and 12 days after receiving the plans. Charlie and his son, Marshall, are gluttons for punishment - they are building two Defiants. Number 2 is structually complete. These guys really get with the program! They have already completed two Long-EZ's and Marshall is building another Long!! Wow.

Don Foreman, from Kent in England, is essentially done with his Defiant and from the photos he has sent us, it looks like a beauty. Don, of course, was the first to complete a VariEze as well as a Long-EZ in England. Unfortunately, Don has run into a problem with the English equivalent of our FAA and is having a very difficult time getting his Defiant licensed. They are demanding a static load test.

Byrdell Mathews has finally got his Defiant flying well and has flown off his restricted hours. Byrdell had all kinds of power problems, could not get enough static RPM nor enough RPM's in level flight. Tried different props to no avail, finally traced the problem to wrongly timed magnetos on both engines! This was done by a real aircraft mechanic! Once corrected, this solved his low RPM problem as well as his overheating problems. Byrdell made it to the Kerrville fly-in so we should see his Defiant in some of the magazines.

There are now seven Defiants flying that we know of. Not bad in a little over 2 years since plans went on sale, especially such a complex machine!

Here are some weights on Defiant parts. You should be close to these weights if you are doing good work:

Wings - complete with ailerons (no winglets)	77 lbs.
Winglets - complete with comm. antenna and cable	9 lbs.
Canard - with two nav. antennas (no elevators)	75 lbs.

Elevator - complete with mass balance - each	10 lbs.
Rudder - with servo and tab (no mass balance)	3 lbs. 12 oz.
Fuselage - complete with 3 gear/wheels, seats, canopy, windows and two engine mounts	256 lbs.

All above weights were taken while the parts were structurally complete, but before any micro or other finishing material was applied.

SHOPPING

A 12V as well as a 24V pump is now available from Wicks Aircraft, both of which have male dash 6 fittings integral with the pump body! This makes it a piece of cake to attach fuel lines since you don't need AN elbows or 45 degree fittings, and it gets rid of the problem of 1/8" pipe threads which most of the of the original Facet pumps had. Part numbers and prices from Wicks are:

#40108 - 12V with 37 degree male fittings	$29.75
#48610 - 24V with 37 degree male fittings	$32.50

Contact Wicks Aircraft for further information.

Ian Ayton's gear/canopy/alternator warning device - a neat, easy-to-install, self-contained unit, it should be considered a "must" for all EZ's. The warning light flashes and the horn buzzes intermittently making it very difficult to ignore.

Contact: Ian Ayton
(213)375-9269

Jim Shultzman's pure silicone canopy seal, a very fine, "V" shaped seal. The best we have seen is still available but not for long. Jim (who now works for Composite Prototypes) is getting out of the business. He has a limited number of canopy seal kits.

Contact: Jim Shultzman
Building 13 - Airport
Mojave, CA 93501

Retrofitable Fuel sight gauges - machined from PVC, not only gives you a crystal clear view of your fuel, but also damps out the fuel sloshing making it easy and accurate to read fuel levels. Easy to install on new or existing EZ's.

Contact: Wes Gardner
1310 Garden St.
Redland, CA 92373
(714)792-1562

Nick Ruys has found a fine heat gun, one we have tried and like. It has two heat settings and gets hot enough to heat-form PCV foam, and also does a great job of shrinking heat-shrink tubing onto your wiring. Lots of uses for any composite airplane builder.

Contact: Nick Ruys Send $40.00 (US)
P.O.Box 10 (519)539-9886 (work)
Ontario, N4S 7W5 (519)423-6322 (home)
Canada

DEFIANT BUILDERS: Fred Mahn has extrapolated the performance charts from the 160 & 180 hp charts for the 150 hp Defiant using a computer. These six sheets are very professionally done and can be obtained from Fred for $5.00.

Contact: Fred Mahan

1415 Glen Haven Drive
Merritt Island, FL 32952

Gene Zabler still has his "oh, so simple" and "oh, so super" cockpit air vent controller available. This is such a neat solution to the problem of adjusting cabin air flow, you will wonder why you did not think of it. Takes just 10 minutes to install and really does work.

Contact: Gene Zabler
48 Ribon Hill Drive
Racine, WI 53406

Send $6.50 to cover cost and postage.

Tired of your rocker covers leaking oil? The only cure we have ever seen are REAL valve cover gaskets. Mike has a set of these on his Long-EZ engine for over 300 hours with no trace of a leak. They are reusable, too! Made from silicone rubber, they should last through TBO on any Lycoming or Continental engine.

Contact: Doug Price
The Real Gasket Corp.
P.O. Box 14852
Portland, OR 97214
(503)233-1613

Bill Bainbridge now has available a really first class lightweight 12-volt starter which will fit any 4 cylinder Lycoming engine. Weighs only 10.2 lbs. It is beautifully made and really has some neat features. Bill still has his well known linear regulators and small alternators. In addition, he how stocks excellent "Gelcell" or sealed, immobilized electrolyte batteries. Two options are stocked, 28AH, 12V or 15 amp, 12V. These are supper little batteries and require zero maintenance. Contact Bill for more information:

B & C Specialty Products
518 Sunnyside Ct.
Newton, KS 67114
(316)283-8662

Gary Hall has an excellent aileron/rudder hinge pin kit. Consists of enough Teflon tubing and stainless steel pin stock to convert your aileron and rudder hinges on a Long-EZ or VariEze. This is retrofitable and well worth the effort. A comprehensive instruction sheet is included.

Contact: Gary A. Hall
4748 NW 43rd. St.
Lauderdale Lakes, FL 33319
(303)484-4949

Rusty Foster's Space Saver side panel is now better than ever. Rusty has redesigned it and it now looks like something off a space shuttle - really a beautiful piece of work. Puts all of your circuit breakers and switches on the right side above the control stick.

Contact: Rusty Foster
P.O. Box 1569
Portola, CA 96122
(916)832-5993

FEATHERLITE PRODUCTS, INC.
P.O.Box 781
13451 Airport Road
Boonville, CA 95415
(707)895-2718

Be sure to write or call for a quote and compare prices and quality with any of the other outfits. Keep in mind that Larry and Michael are the only RAF approved and recommended manufacturers of prefab parts for all of RAF designs.

FOR SALE
Two (2) Marvel-Schebler 4-5 carburetors. Call:
Dr. George Best,
(602)991-0476

Original VariEze main gear and other EZ parts. Call:
Frank Drefs,
(301)843-1100

Long-EZ firewall aft. Includes Lycoming 0235-L2C, 245 hrs. SFREM, mount, 4" extension, exhaust, Great American Prop, oil cooler, 35 amp alternator, baffling and all engine instruments. Donating our Long-EZ to a museum and building a Defiant. Call:
Ron Van Bladeren with best offer
(503)642-3307

Oil screen with Vernatherm - trade for spin-on oil filter housing. Also, 3 1/8" diameter round transponder - $150.00, electric tach - $25.00. A few other Long-EZ items. Call:
Tom Williams,
(803)287-9291

DEFIANT BUILDERS - Don Foreman, Defiant builder in England has available a really neat nose wheel shimmy damper. It is ideal for use on a Defiant. It is easy to mount and has a unique adjustable damping system.. Best of all, it is rather inexpensive - $36.00! Don will send one to anyone who will send him $36.00 US plus postage. Write to:
Don Foreman
Hillside
Malyons Road
Hextable
Kent BR8 7RE
England
phone direct - dial 44-322-64028

Radair R-250 Transponder - very recent factory overhaul and certification - $225.00. Contact: Mike or Sally
(805)824-2645

RAF SPECIAL SALE
Half price sale on all belt buckles in stock. Pot luck. Defiant, Solitaire, VariEze (no Long-EZ). Please specify aircraft type. You may be sent either a large or small buckle, brushed or shiny. If you have a preference, let us know, we'll attempt to accommodate you. A

great Christmas gift for builder or flyer. All belt buckles - $10.00. California residents add .60 for state tax.

FUEL VALVE LUBE
Mike and Sally offered a very expensive and very special grease for this purpose for some time but have run out. They will not be ordering more. Anyone who would like to may contact:

Burmah - Castrol
16815 Von Karmen Avenue. Suite 202
Irvine, CA 92714
(714)660-9414

The grease was formerly known as Brayco 3L-38RP, now Braycote 601 and can be bought as follows:

2 oz. for $190.00
4 oz. for $300.00
1 lb. for $800.00

Very expensive, but the only grease we have tested that really works.

ACCIDENTS AND INCIDENTS
A Kansas based VariEze crashed, fatally injuring it's builder/pilot. The circumstances of this crash are the stuff nightmares are made of. The left wing separated from the fuselage in flight and the airplane fell out of control to the ground where the right wing also separated from the fuselage. Examination of the wreckage showed that the 16 screws (AN-509/AN-525) that must be used to fasten the wing-attach fittings to each wing spar were never installed! Surprisingly, the same 16 screws that are used to attach the wing-attach fitting to the centersection spar were installed. As a result, only the epoxy bond held the wings to their fittings. Incredibly, this enabled the aircraft to fly for a number of hours before the top and bottom spar caps simply pulled out of the metal wing attach fitting.

This builder/pilot, by all reports, was a careful builder who built his VariEze closely to the plans, yet while he did install the wing attach screws into each of the centersection spar, he somehow overlooked the installation of these critical screws into each wing. Why? We will probably never know, but we should all learn a lesson from this. Even though the plans are clear and concise, with full size drawings showing the location of these screws, it is apparently possible to overlook such a vitally important structural attachment. Every VariEze builder or flyer should check to be absolutely certain that all 64 screws are installed in the wing/centersection attach fittings. If you have already covered these screws, such as in an already completed and finished airplane, you can easily check using a small magnet hanging on a string, or a stud finder such as carpenters use to locate vertical studs is a wall (it's also a magnet). Carefully mark the exact location of each screw head with a pencil. Compare your bolt pattern with the full scale drawing in the plans. Be sure that you have all 64 screws in the correct positions. This applies especially to those who have not done this work themselves and therefore would not know.

A Texas Long-EZ lost power and hit power lines as the pilot attempted an emergency landing. The airplane nosed over and crashed, seriously injuring the pilot. The reason for the power failure has not been positively determined.

A California VariEze lost power while on a cross country flight still 200 miles from the pilot's intended destination. The pilot landed on a highway, crashing through a fence. The VariEze was heavily damaged but the pilot walked away with cuts and bruises. The reason for the power failure has not been positively determined.

What can be learned from this type of accident? Complete engine failure, if not a mechanical failure such as a broken crankshaft or connecting rod(s), is generally fuel associated. With redundant magnetos, ignition is seldom cause for a complete and sudden engine stoppage. Catastrophic mechanical failures, while they do occur from time to time, are quite rare in aircraft engines. Sticky or stuck valves occur more often, but again, this seldom causes a complete power failure., Most of these types of failures will result in a partial loss of power which, while very nerve wracking, should still enable a pilot who stays cool to reach an airport or, at least, make a safe emergency landing.

Fuel related engine problems in homebuilts generally come under two headings: Simply running out of fuel (brain failure!), or a faulty fuel system that for one reason or another fails to allow fuel to reach the engine. This could be caused by many things. Deviating

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from the plans is probably the most common reason. Clogged filters, substandard hoses or fittings, old, worn-out carburetors, sticking floats, wrong fuel pumps, disregarded inspection, - we could go on all day!

RAF is not an engine oriented company, our expertise is in aerodynamics and composite structures. While we have some experience with engines, we can only offer general guide lines. Get expert help with your engine installation. Check with the local airport mechanics, have other members of your EAA chapter look at your engine controls/hookups, your baffling, your fuel lines, etc. Tony Bengelis' book Firewall Forward is a great source of information on engine installations.

Before first flight, do conduct a fuel flow evaluation per owners manual Appendix I. For a Long-EZ, this test should also be conducted with the electric boost pump running. The flow should now be at least 20 gph. If these flows are not achieved, do not attempt to fly until your have located and corrected the problem. If your engine cannot get fuel, it will cease to run. This will give you an immediate, very serious problem which, unless you happen to be over or near a suitable landing site and unless you keep cool and judge it perfectly, could possibly result in the loss of your life.

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting

the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

VARIEZE PLANS CHANGES

MAN-GND
Using a magnet or "stud finder", verify that all 64 wing-attach screws are installed. See details in this newsletter.

MAN-GND
Add the words "and positively locked" after "check fuel caps on" in the checklist. Add the following: "warning loss-of-cap or deteriorated O-rings in the cap can result in all fuel being sucked into one tank. Check caps and O-rings before each flight. NEVER fly without a full, selectable header tank. This is the only way to keep the engine running after loss of cap, clogged vent, or other fuel problem. Restart should occur within 10 seconds after selecting the header. Maintain at least 80 knots for positive prop windmill."

NO LONG-EZ PLANS CHANGES

NO DEFIANT PLANS CHANGES

NO SOLITAIRE PLANS CHANGES

Please report any significant plans errors so that we may print correction in future editions of the CP.

Clarification of changes to VariEze and Long-EZ control systems aft of the firewall called out in CP 49.
As any plans owner knows, the aileron control system aft of the firewall consists of aluminum pushrods and several thin aluminum brackets. The intent of the plans change is to assure that an EZ pilot

will retain, at least, roll and pitch control in the event of a serious engine compartment fire. Obviously, pitch control would not be effected by an engine fire, but it may be possible that an aluminum pushrod or aluminum bracket might be melted thus robbing an EZ pilot of lateral (roll) control in the event of a serious but otherwise survivable engine compartment fire. For this reason, we have carefully evaluated the control system for fire survivability. We have decided to only preserve the lateral (roll) control system, and to let the directional (rudders & brakes) system go. Our reasoning is that in such a serious situation as a bad engine compartment fire, the most important thing is for the pilot to retain sufficient control to be able to safely execute an immediate emergency landing. Pitch and roll control are all that are absolutely necessary for this. Stopping, once on the ground, can be accomplished by collapsing the nosewheel.

Toward this end, we are recommending in the strongest possible terms, the direct replacement of all aluminum pushrods aft of the firewall, with 1/2" O.D. x .028" wall 4130N steel tubing. The CS-1 aluminum threaded inserts in the ends of the aluminum pushrods should be replaced by steel inserts (part #CS-50). These inserts should slip inside the 1/2" O.D. x .028" wall steel tubes and should be fastened with four (4) stainless steel pop rivets, such as Cherry #CCP-42. Your existing dash 3 rod-ends can be screwed into these CS-50 inserts. In addition the four CS-127 aluminum brackets on the aft face of the VariEze centersection spar and in the wing root of the Long-EZ must be replaced by steel parts fabricated from .032 4130N steel. Ken Brock will have both of these parts available by mid November. They will be cadmium plated steel per RAF's specification.

Since this was published in CP 49, we have received all kinds of mail, mostly wanting clarification. Hopefully, the above has done that. We also received a few derogatory letters suggesting we were simply trying to "cover our -ss". Obviously, anyone is entitled to his opinion, but you should know that a decision to make such a change as this one is not taken lightly. First of all, RAF's agreement with Brock means that RAF has to buy all remaining inventory such as CS-127 aluminum brackets and CS-1 aluminum threaded inserts.. Secondly, a change like this is always confusing to many builders and our workload on builder support goes up dramatically. Thirdly, and most importantly, we have tried and will continue to try to make any change necessary to make flying RAF designs safer, no matter what it costs or what anyone thinks. We have an awful lot of friends out there and are very sincere in our efforts to provide any information to make flying these airplanes safer. Last but not least, we cannot force anyone to make any changes, we can only print the suggestions in the CP. It is up to you whether you comply or not. Naturally, we hope every one will because these changes are not made on a whim. However, we do not have the authority to force you to ground your airplane and make the change, only the FAA can do that and then usually only when it concerns certificated airplanes.

MAJOR CHANGES - YOU AND THE FAA

Quite a number of EZ builders have been making "major" changes to their EZ's and not working with the FAA, either because they don't realize they are required to or because they don't realize that what they have done is a major change. A classic example is an engine change to a larger engine. Now RAF cannot recommend a change such as this, but we don't like to see our builders getting into trouble.

If you decide to make such a change after you have already had the airplane licensed and signed off, you must contact your local FAA and work with them to keep yourself and your aircraft legal. "Who will ever know?", you may say! "We did not even change the cowling.", you say! Well, here is the straight skinny. As soon as your make a major change as defined by the FAA, your airworthiness certificate is automatically invalid. Worse than that, your insurance is also invalid.

If you should have an accident that would damage someone else's property, your insurance will not pay - you or your survivors will pay. That could be a really nasty problem. On top of that, the FAA takes a very dim view of this sort of thing and they will prosecute you. The penalty is not some little thing to laugh off, either. The fine is $1,000.00 per flight!!

As you can see, very obviously, it is not worth the risk, especially since it is so easy to comply and keep everything above board and legal. All you have to do is to inform your local FAA what it is that you are planning to do. They in turn, will issue you a new, temporary, airworthiness certificate which will again limit you to within a 25 mile radius of your airport for a certain number of hours. Normally, this will be from 5 to 25 hours depending on the change and on the local FAA official. After you have successfully completed your test flying in the local area, or have flown off the hours, the FAA will issue a new "permanent" airworthiness certificate, and you are back in business, and your insurance is valid.

Do yourself and the homebuilt movement a favor, comply with the regulations and keep yourself and your airplane legal. It is an inconvenience and may take a week or two but, in the long run, you will be much better off and you may save yourself or your family untold grief.

BUILDER HINTS
"Fire-Proofing" your firewall: by Arnie Ash (Reprinted from Central States Newsletter).
"The arrival of the latest Canard Pusher just two days before leaving for Oshkosh and also just prior to mounting my engine for the final time was indeed timely. The following is an account of a few thoughts regarding the purchase, application and protection of Ocean 1644 "fireproof coating".

To coat to the proper thickness your firewall and side "heat shields" you will need more than one quart of 1644 but less than two. Wicks prices this material at $25.00/quart or $60.00/gallon. It would seem that perhaps three EZ's could be treated with one gallon so you may want to consider splitting the cost of a gallon with a couple of your buddies. You will also need the special thinner which sells for $15.00/half gallon. (You'll use less then a cup of this material though).

Application: Grab the oldest spray gun you can find - you don't need to break out the high priced equipment. Thoroughly mix the 1644 and draw off approximately 3/4 of a quart. Cut this by about 5 percent with the special thinner. Set your spray gun up in the suction mode with about 50 lbs. pressure at the gun. The material seems to flow on best at a range of only 5-7 inches from the part being sprayed. To get the required material thickness you'll have to spray 7 to 9 coats (depending on the thickness of each coat). Allow a few minutes between each coat for the material to "tack" and you'll avoid any runs. (If all goes well you'll have the firewall coated to the required thickness in less than 45 minutes. Wear a good mask and be sure to protect the rest of your airplane from any overspray). This material needs a couple of days to really give you the feeling it's dry.

Once dry you'll have a nice white firewall - - until the first time you touch it with dirty hands or spill a little oil on it. This material appears to be pretty porous and thus absorbent. I called the manufacturer, Ocean Chemical, Savanna, Georgia, inquiring as to the availability of a top coat to help keep the firewall looking nice.

Although they apparently have a product, their lab suggested an excellent top coat would be Imron 500-S Clear polyurethane enamel, sprayed to a thickness of about 3 mills. The problem: If you go to your local paint dealer and buy the smallest container if Imron 500-S and the 192-S activator required you will have as much invested as the Ocean 1644 and you'll only be using about six ounces!!

ONE SOLUTION: Ask the paint dealer who his biggest customer for Imron is and go tell this "end user" your tale of woe. In my case it was the local "Big Truck" body shop and enough Imron 500-S and 192-S cost me a case of Pepsi!

Mix the Imron at a ratio of 3 parts of 500-S to 1 part 192-S. The firewall will take about 4-5 ounces. Application is handy using one of those $3.00 aerosol "touch-up" bottles you can pick up from the guy who told you who his biggest "end user" was. (At least he sold you something!) Spray this material just as you would any "lacquer type" material. This stuff will run easily so best to spray a light coat and let it tack for 10-15 minutes then follow up with successive coats until you achieve the desired thickness.

One last thing: Even though you will only be spraying a few ounces do not under any circumstances attempt to spray this material without a very good mask. I used a good mask and pumped fresh air from a bottle into the mask to create a positive internal air pressure, and I still got a mild headache. This is nasty, nasty stuff. Be careful. . . . Arnie

P.S. At normal room temps. the Imron will take at least two days to cure to the point where you can work on the firewall. Total cure, they tell me, takes about two weeks."

Long-EZ builders/flyers have known for a long time that the number 4 cylinder usually runs hottest. Many of you have speculated that the firewall mounted air filter and associated scat hose to the carburetor may be blocking the cooling air to number 4. Dick Kreidel has

designed, built and quite thoroughly tested a neat solution to this problem and it really works well. Mike is in the process of building one just like it. It is so simple you will wonder why no one else has thought of it!

A 1/16" thick 2024-T3 aluminum plate is the :base". Two aluminum extruded angles are riveted to this "base", see photo number 1. An AN4 bolt connects the two angles with an aluminum tube spacer over the bolt and between the angles to allow the AN4 to be tightened. These angles are shaped to "nest" against the starter. Two stainless worm gear clamps (hose clamps) go around the starter body and around the aluminum spacer tube to hold the "base" firmly against the starter. In these photos, Dick has an Amsoil foam filter but the standard paper filter will do. The stock Brock carburetor heat valve assembly is used just like it was on the firewall to hold the filter in place with four tension springs.

Photo number 2 shows the scat hose inlet duct with fiberglass elbow and the scat hose going to the carburetor heat source. The carburetor heat valve return spring is hooked at a small bracket on the alternator mounting bolt.

This set-up is sanitary, simple and puts the air inlet filter where the highest pressure cooling air is, right up against the aft lower baffle. This, also, gives you a nice, clean, roomy firewall. Dick has found that his cylinder head temperatures run more even, too. It certainly looks like it is worth a try, especially for anyone who has a very crowded firewall or a hot number 4 cylinder.

DEFIANT BUILDERS HINT: From Charles Sims' Texas Newsletter.

"Installing the Mooney nose gear. First, build with a new tire. Several builders have used worn out tires to build and find out, only too late, the box is too small for a brand new tire. Second, build the box about 1/8 to 1/4 inch longer by moving the instrument panel (lower portion only) aft just a little. This will make the side of the box too short, so remember to make the patterns longer. Then put one layup on the outside of the box, it will glue together easier and align better. The plans call for gluing the foam and plywood together with the solid 1/4" of glass. You have a more rigid assembly with one ply of glass on the outside over the foam and NGB-1. My nosegear worked out very well fitting into the lower box. However, my retract NG-2 had to be trimmed to fit between the bushings NGB-18. One other little tip. Look in picture #340. See the extra piece of foam which is on the top of box? Do not forget this, I missed it the first time and had to go back and move the front of my box out to clear the tire. It shows up on page D-39 also, but no arrow points to it as it does the other two pieces of the lid."

CAUTION - MECHANICAL FUEL PUMPS
It has come to our attention that the FAA has received numerous reports of these pumps leaking; to complete in-flight pump failures; even to in-flight fires. Apparently, the most common cause of this type of problem is the loosening of the diaphragm screws. It has been reported

in several national publications that A.C. will no longer be producing these mechanical fuel pumps due to the liability problems associated with such a failure. New pumps are already becoming scarce and rebuilt kits are no longer available anywhere to our knowledge.

Take care of your A.C. fuel pump. Keep it clean. Inspect it carefully for leaks. Be sure that the A.C. pipe thread adapters are tight and the "o" rings are in good condition and are sealing properly. There should be no fuel stains (leaks) anywhere, the AN fittings should be steel and should be tight and have no leaks. It may not be a bad idea to substitute aircraft quality AN-3, drilled-head bolts for the screws and lock washers. Be careful not to overtorque these bolts and do safety wire both bolt patterns.

If anyone has more information on A.C. fuel pumps, repair kits, etc., we would appreciate hearing from you.

A MISSING FUEL CAP on a gravity fuel system can be a very real problem. We have talked of this problem before in the CP as well as at airshow, and this year at Oshkosh was no exception. In fact, one VariEze pilot had had a first hand experience and was able to verify what we have said in the past.

In a VariEze (or Cessna 150) which have gravity fuel systems, both tanks feed together to the engine and there is no mechanical engine driven fuel pump and, also, no electric boost pump. This system is simple and works very will as long as the fuel tank vents are open, allowing ram air to pressurize each tank equally, and as long as both fuel tanks caps are on.

Now, if one cap comes off (or even stays on but leaks badly) the fuel in that tank will be syphoned overboard (low pressure on the top of an airfoil), because a gravity fuel system has both tanks plumbed together. This means that the fuel in the tank with the cap on will be sucked across and into the tank with no cap. Of course, it will also continue to supply fuel to the engine until it is empty. When it is empty, however, your engine will quit, even though you still have most of one tank still with fuel in it (the one without the cap). The low pressure over the missing cap hole will not allow this tank full of fuel to gravity feed down to your carburetor. Selecting the header tank will allow engine restart within about 10 seconds.

This problem does not exist on an airplane with a pumped system (such as the Long-EZ or Defiant) since the two tanks are not plumbed together.

Check your fuel caps yourself, carefully and conscientiously, every single time you get fuel, whether you put it in yourself or have the line boy do it.

Another associated problem particularly on a VariEze, is that the loose fuel cap will go through the prop and can damage it, sometimes seriously enough to cause an emergency landing. It is an excellent idea to attach your fuel caps to the fuel tank with a 6 inch length of light chain.

Wes Gardner stopped by RAF just yesterday and he was still shaking in his boots from just such an experience. He was very, very lucky and managed to stretch it to an airport and, therefore, did not suffer any damage other that a large ding and some cracks in this prop - be careful.

"Dear Mike,
Thought I should pass on some information about nose wheel tube failures I've experienced and what was done to hopefully prevent future occurrences.

It all started with about 100 hours on the airframe. The nose tire went flat just after landing touchdown. The shimmy got quite violent and it wasn't until after we got it stopped that we knew is was a flat. I thought for sure we had broken something.

It appeared that the tube had been creased when it was originally installed in the tire by the supplier (back in 1976). The tube through use evidently moved around and the creased smoothed out. The failure occurred where the tube was creased, apparently due to it's age. A replacement was obtained from a fellow builder who happened to have a spare from a kit he had picked up.

Sixty hours later the nose tire went flat again. This time, luckily I had just started to taxi when things went all wobbly. The unlucky part was that I was 400 miles from home on a Sunday morning and I had a golfing date 250 miles away. To make a long story short, I was able to talk a very generous local builder into taking the tube from his project so that I could get under way. The failure this time was due to a pinch on the valve stem. This was either poor assembly or that the tire had rotated slightly to cause the interference with the rim.*

Eight hours later and fortunately, during taxi at the home port, another failure occurred. I was beginning to develop a phobia at this point. The failure this time had occurred in a manufactured seam of the tube. There is a good possibility that this tube also was quite old.

This time we replaced both the tire and tube with new (or at least recently purchased) units. We also drilled the rim and installed three equally spaced screws on each side of the wheel to prevent the tire from rotating. This is the same method used by automobile drag racers for years. The screws are self tapping and extend into the bead of the tire about on eighth inch. So far, we've got thirty hours on this setup with no problems.

I would recommend to anyone who has an old inner tube, especially from the 70's vintage kit, to replace it, or them, if the mains are that old also. I was lucky, these failures could have easily resulted in damage to the airplane.

Best regards,
Herman J. Kuebler"

*EDITOR'S NOTE: We have found that the best method of preventing the tire from rotating on the wheel is simply to keep it inflated to at least 40 psi. Because the nosegear is retracted while the EZ is parked, the nose tire gets very little attention and, if the pressure gets down to 15 or 20 lbs., the tire will rotate and the valve will pull out of the tube.

"Dear Folks at R.A.F.
I am very pleased to announce that N721EZ made it's first flight earlier in September and as with many of the other builders the initial flight went off perfectly. Performance has been without exception, right out of the owners manual.. Basic empty weight is 853 lbs., with starter, wheel pants, and a 25 amp/hr gell cell up front. 125kts IAS @ 2500 rpm fits very well within the 65% power range. I now have over 22 hours of very enjoyable time and look forward to completing the required time.

Although I'm happy to report the excellence of this design, I actually wrote to describe a problem I had after the fourth hour. Having made the modifications to the flight controls in the last CP (LPC 131) and coating the firewall with the intumescent paint, I had the crankshaft seal split and lost two quarts of oil over a one hour period. Fortunately, I kept my first 10 hours down to one hour segments. On removal of the cowling, I decided to run a short inspection and discovered very small fuel stains running down the firewall from the Facet fuel pump. Had I not had the new firewall paint on, I might not have noticed the stain. The stain was reddish and did not coincide with the 100LL fuel which confused me at first. The stains were not very much at all and I was almost going to dismiss them but I elected to turn on the fuel pump and watch it for awhile. After 5 minutes, a single drop of fuel dripped out from the back case of the pump.

A few drops of fuel over a 5 minute period does not seem like much but it was enough for me and off came the pump. Close inspection did not show any fuel coming from either of the fittings so I pried open the back of the pump and there found a surprise. The central core of the pump was wrapped with coils of enamel coated wire

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(red) and then finished wrapped with cloth. The cloth was soaked with fuel and stained red I presume from the fuel acting on the enamel wire insulation. It's anybody's guess what further progress this may have taken. I am in the process of returning the pump for inspection.

Since the last newsletter had important information the fire hazards, I thought I would pass this information along to you.

If I may make any suggestions to builders on their initial flight test program, keep the first few flights short and near airports in the restricted areas. Also, even though the cowlings may be a small inconvenience to take off, during these first few hours remove them and check things over.

Once again many thanks,

Rick Glos"

EXCERPTS FROM LETTER TO MIKE FROM SOLITAIRE BUILDER,
HERBERT C. ABRAMS
"Solitaire builders' bull sessions have gone international! The attached photo tells it all. From left to right: Herb Abrams, Columbus, Ohio; Bjorn Bostad, Vollen, Norway; Runa Pedersen, Tonder, Denmark; Ole Ploug, Augustenborg, Denmark; Kjeld Pedersen, Tonder, Denmark. Bjorn is a 747 pilot for CargoLux, Ole is an engineer and Kjeld, Ole's partner, is a body shop owner. They are all good craftsmen. Runa is a student, a glider pilot and a participant. We brought her the T-shirt. The picture was taken in Kjeld's shop in Tonder where he and Ole are building their Solitaire.

Ole and Kjeld wanted a total building experience so they started from scratch with a lofting drawing of the fuselage translated into a plug, then molds, and finally a fuselage. They made spar molds and spars. Their work is outstanding. The fuselage is a wet layup and, with a clear resin, has a little different appearance but the contours are exactly as they should be. Both Bjorn's and Ole/Kjeld's ships are at the same point of completion. The fuselage has been assembled as per the plans and so has the canard. They are working on the wings and also starting control installations.

We reluctantly left our new friends with whom we developed very strong attachments, to continue our trip with a three day bus ride through mountains and fjords to Bergen. Then we boarded a coastal steamer for an 11 day trip to 35 ports along the Norwegian coast north to North Cape and the border of Russia. It has taken two weeks to recover, so work on my Solitaire is now two months behind."

AND ONE MORE LETTER

"Greetings from Spain,

In September I finish my tour of flying F-16's in Madrid, Spain and will return to civilian life on Cape Cod, Massachusetts. Please note the change of address.

In the past six months I have had a fantastic time logging over 120 hours in Europe on my (built in Texas) Long-EZ, N27PM. I have flown to eight countries, crossed the Pyranees eight times, and flown over the Alps twelve times and attended the British, French and Swiss homebuilt fly-ins. It's been a truly fantastic spring and summer EZ-wise in Europe. Many thanks to you at RAF for a terrific design and all the great builder support!

Peter C. Magnuson"

MEXICAN VACATION WEEKEND
Dave Kolstad (who went last year) reports that this is a super neat fly-in. Mexican EAA Chapter 815 is holding their second annual fly-in at Puerto Escondido this coming November 27th thru 30th. A brand new hotel with the newest airport in Mexico (Toluca airport, 163 NM on the

102 degree radial out of Acapulco VOR) has tie down rates of only 75 cents US per day. A race will be held for anyone interested on Friday, the 28th of November. Miles of unspoiled beaches, good food, good company await those who would like to join Dave in flying down. He has installed a rear seat auxiliary tank in his VariEze and intends flying down non-stop!

Should be a really fun, low-cost weekend.
Contact: Dave Kolstad
(818)349-3274
SASE 9955 Babbitt Avenue
Northridge, California 91325

MIKE AND SALLY'S 25TH WEDDING ANNIVERSARY CELEBRATION
FLY-IN AT MOJAVE
I woke up quite early on Sunday morning and looked at Sally. To my astonishment, she was wide awake and had a silly grin on her face. I hastily closed my eyes and pretended to be asleep while I tried to figure out what was going on! I peeked again, same silly grin! Finally, I said, "What's up?" She said, "We have to get up and go to Mojave." I said, "No way, it's Sunday. I've worked every weekend for the last 8 in a row. I'm going to stay right here." She said, "I have invited a bunch of EZ people to a fly-in at Mojave to celebrate our 25th anniversary." It took a while to sink in, but I finally realized she was not kidding and that we really did need to get up and get down there in case anyone showed up.

Well, it turned out to be an absolutely beautiful day in Mojave and 48 VariEze's and Long-EZ's flew in to spend a few hours eating good food and swapping tall tales. It was great - I had a ball. It really was the neatest wedding anniversary present any pilot could possibly wish for. I got to visit with lots of old friends and to meet many new ones. Ralph Gaither flew his VariEze in from Pensacola, Florida and R. K. Campbell from downtown Ducktow, Tennessee flew in in his beautiful Long-EZ. He's 69 years young and says he is having a ball flying his Long-EZ to fly-ins almost every weekend. Thanks to everyone for helping make such a neat day.

Some of the 48 EZ's that flew in to Mojave to celebrate with Mike and Sally on Sunday, October 19th. **PHOTO OMITTED**

Wow! Look at those carbon fiber wings bend! The Voyager over Edwards Air Force Base at almost 8000 lbs. gross weight. **PHOTO OMITTED**

FIRE EXTINGUISHERS IN THE COCKPIT
With our recent experience of a brake fire while taxiing the Defiant, the value of an on-board fire extinguisher became painfully evident. If we had not had an extinguisher, we would have lost the Defiant!

We have done a little research into the subject of fire extinguishers and the consensus is the "Halon" extinguishers are the only ones to consider. There are two types of Halon, 1211 and 1301. FAA says that Halon 1301 is best. However, the much more readily available Halon 1211 is still an excellent choice and is available in a small size well suited to our EZ cockpit. A lot of mail order catalog houses, such as Sporty's Pilot Shop, sell these fire extinguishers. A 2-1/2 lb. Halon bottle is well suited to a Defiant size airplane, but is really bigger

than necessary in an EZ cockpit, while the tiny, aerosol size 12 oz. Halon bottles are probably marginally too small although they may well be a life saver if used soon enough on a small fire. They certainly are easy to mount in our small cockpits. Be sure you place the fire extinguisher where you can easily reach it in flight.

Do not use a dry chemical or a CO2 fire extinguisher in any aircraft for any reason.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Photo #1 - Dick Kreidel's intake system showing method of clamping to starter and foam filter - view is from right side.

Photo #2 - Dick's intake system from left side. Brock carb heat valve assembly is used. Dick has a carb heat shroud over his left exhaust - he reports complete satisfaction with this system.

Larry Lombard, FEATHERLITE PRODUCTS, INC., with their Long-EZ fuel strake kit. All ribs and baffles come with a prefab leading edge.

Michael Dilley, FEATHERLITE PRODUCTS. INC., holding a Defiant main gear strut, with 3 Defiant cowlings behind him.

"The finishing touch" goes on the side of Bill Hemmel's Long-EZ prior to first flight - what an appropriate name for a Long!

Seen at Mojave - this is what happens when you get carried away with the nose shape - you can't park it on it's nose!

Joe and Della La Coure, New Orleans, Louisiana with their new Long-EZ. This striking looking EZ was on the flight line at Oshkosh where is was much admired.

Charlie Gray's newly completed Defiant still in primer - near Kissimme, Florida.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Cesar Contrenas, Serial No. 1685 Long-EZ of Tuxpan, Ver. Mexico trying it on for size - Looks very good, Cesar!

"First flight in the living room" - Charlie Maddox, looking quite pleased with his efforts so far - all of us have been here, haven't we?

Harry Manvel and friends on their first flight of fantasy in Harry's Defiant at Tracy, Michigan.

Herb Abrams; Ohio - Bjorn Bostad; Norway - Runa Pedersen; Denmark - Ole Plugh; Denmark - Kjeld Pedersen; Denmark, Solitaire builders all.

Peter Magnuson, N27PM, USA - Gianni, Zuliana, Imeze, Italy - Andy Daper, G-LEZE, England. Long-EZ builder/pilots at a fly-in in Lugano, Switzerland.

John W. Nicholson, of Toronto, Canada, taxiing out for his first flight in his fine looking Long-EZ.

Don Druckenbrodt, Garland, Texas - won't be too long now, Don! Looking good, hold tight, Son.

F. Vicaire of Chenin de la Begere Battue, France - first flight of his VariEze on August 3, 1986.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Don Foreman, England, first VariEze, first Long-EZ and, now, first Defiant builder - drilling in his Defiant wings.

Don's neat idea for assuring that the wing attach hardpoints are level and true. This guarantees that the wings will fit perfectly to the C/S spar with zero shims and correct incidence.

Don's Defiant fuselage took six strong guys to flip it over - it weighs 526 lbs. at this point.

Don's method of drilling straight, square pilot holes through the C/S spar and wing-attach hardpoints - simple, but clever. Of course, these ideas will also work on a Long-EZ.

Ole Ploug of Augustenborg, Denmark, tries on the Solitaire fuselage he literally built from scratch! The plug, the molds and the prefab parts!

Ole's very sanitary "S" glass roving wet-out machine - saves space, too!

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Marc Boron's "Six-Echo-Zulu" just prior to moving her to the airport where Marc flew the first flight on the 31st of August, 1986. Congratulations, Marc.

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 51. If you are building from 2nd Edition plans you must have newsletters 18 through 51. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 51. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 51. If you are building a Long-EZ you must have newsletters from 24 through 51. If you are building a Solitaire, you must have newsletters from 37 through 51. If you are building a Defiant, you must have newsletters 41 through 51.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY
We would like to apologize for the fact that there was no January 1987 newsletter. Unfortunately, we simply did not have time to write it, type it, paste it up and get it printed. This process usually takes about 3 weeks and we would normally have been doing this in late December and early January. As most of you know, during that period the Voyager was on it's historic "round the world" flight and we were heavily involved in that effort.

Composites Prototypes, a small division of Scaled Composites which not occupies the building that RAF used to be in (building 13 on the Mojave flight line), recently completed its first airplane, a prototype loosely based on the RAF Long-EZ design but with a 30 foot-plus wingspan and using a 210hp, turbo-charged Lycoming engine. Mike Melvill made the first flight on February 27, 1987, and the aircraft is currently involved in developmental flight testing. The design is

proprietary to our customer, California Microwave, Inc. A photo of it on its first flight is printed on the cover of this newsletter.

VOYAGER
Burt, Mike and Sally departed from Mojave in a Beech Duchess very early in the morning of December 14, 1986. They arrived over Edwards Air Force Base so early the tower had not even opened! After a few minutes of conversation with Edwards Approach Control, the runway lights were turned on and the Duchess landed and taxied to the "hammmerhead" area of runway 4 where the Voyager had been parked all night while Bruce Evans and his crew had worked virtually all night fueling her up for the world flight! The wings and canard were covered in household bedsheets! This was an effort to prevent the formation of frost on the flying surfaces. These sheets had been loaned by many homeowners from the town of Mojave.

Obviously, there is not nearly enough space in this newsletter to cover an event of this magnitude in any detail, however we would like to share a few highlights with you.

The take-off roll! Wow! We lined up on Runway 4 off the right wing of the Voyager. Burt was ready with his video camera as Mike eased in the power. The Duchess slowly rolled with the Voyager as she started on what we think may be the longest take-off time ever! At the 7,000 foot marker, we still were not going fast enough to lift off in the Duchess! The Voyager wingtips were dragging on the runway, Jeana was calling out indicated airspeeds each thousand feet, and the Voyager was behind schedule on speed.

Finally, we lifted the Duchess off and continued following the Voyager while we were a few feet off the ground. The end of the runway was rapidly approaching, the end of the 15,000 foot runway! Finally, Jeana called 87 knots, the speed Burt had predicted the Voyager would need to fly. Dick began to rotate and slowly, magnificently, the wingtips rose off the runway and the wings bent into a graceful arch - she lifted off with less than 1,000 feet of runway remaining! The take-off roll lasted for an unbelievable 2:04 minutes! The excitement in the chase plane was short-lived when we realized that the winglets were failing. The frightening moment when the winglets failed and fluttered off, ripping the top and bottom wing skins inboard to the outboard wing tanks - the beautiful sight as the Voyager crossed the coast at Point Mugu and headed out over the Pacific - these are the unforgettable memories. We followed them in close formation until we were almost 300 miles off the coast. A last careful look at the engines, wings, everything but the wingtips looked optimum. We said our tearful "good-byes", waved to Dick and Jeana, and with difficulty, turned 180 degrees and headed back to the coast.

Working in the Communications trailer at Mojave, some highlights come to mind: threading the needle, when Len Snellman guided Voyager around the cyclone "Marge" out in the Pacific - fighting sleep near Sri Lanka - trying to persuade Dick to quit flying and go to sleep - trying to figure out what was going on in the fuel system. The storms and unfriendly countries in Central Africa - oil starvation in the middle of the Atlantic at 4:00 am - the right side fuel transfer pump failing - both engines stopped, gliding for a full five minutes off the coast of the Baja Peninsula at 2:00 in the morning on the last night. Jeana

replumbing the fuel system and then they can pump fuel from the right side - both engines running. Burt and Mike leaving the trailer at 4:30 am to take off in the Duchess to greet the Voyager and escort her in.

At first we communicated via the trailer and HF. Then suddenly, we were able to talk plane-to-plane on VHF. We tracked out of Seal Beach VOR on the 155 degree radial while Dick and Jeana tracked inbound on the same radial with a 1,000 foot altitude difference. It was a black night over the Pacific, almost 100 miles off the coast and we were about to attempt a night join-up. The Voyager had only a very small strobe on the bottom of the left boom tank just aft of the wing. Our DME to Seal Beach was the same - we did not see them, we turned 180 degrees and descended 1,200 feet - now we were 200 feet below them and suddenly, there was a small strobe. Mike requested Dick turn off the strobe for identification and, yes, it was the Voyager, and tears flowed. Slowly we stepped closer, like an apparition, the dark shadow of the Voyager with almost perfectly straight wings, appeared against the background of clouds over the Los Angeles Basin.

The emotional join-up was something Burt and Mike will never forget. There, after completely encircling the globe, was Voyager containing Dick and Jeana, so close we felt we could touch them. It was incredible.

As the day dawned, we sailed over Los Angeles, over an almost solid cloud deck at 10,500 feet. An airliner curved around and descended across our bow as the TV/camera plane flown by Fitz Fulton, the Grumman Tiger flown by Doug Shane, and the Beech Sierra flown by Crew Chief Bruce Evans, all joined up on the Voyager. And we all headed for Edwards.

The excitement of flying off the edge of the clouds and seeing Edwards and Rogers Dry Lake far below, clear and calm; the talk over the radio with Edwards and between all the chase planes and Voyager: the sight of all the thousands of people who had got up at 2 and 3 o'clock in the morning to line the edge of the dry lake as Dick and Jeana flew several passes over the crowd - these are the memories.

Finally, the gear is down and we float in to land on the compass rose, right behind the Voyager. What an effort, what an incredible achievement, what a super couple of real live heros, Dick and Jeana. What an unbelievable airplane, the Voyager. Success at last! The last major unlimited world record in atmospheric flight, captured forever by Voyager and the Voyager team. Congratulations Burt, Dick and Jeana - and the whole team of Voyager volunteers.

Burt has put together a technical talk that includes 110 slides and some exciting original film of Voyager testing and the world flight. He is doing a limited number of these presentations to large engineering audiences.

SUN AND FUN FLYIN 1987
So, if you didn't go, you missed a good one. Superb weather, lots of airplanes and lots of fellow builders to swap tales with. The EZ Race

that has been held every year since Dick Rutan started it in 1981 was run again this year, thanks to Charlie and Marshall Gray. Those guys plus all of the local help they have in Florida really put on a great race and more important, a safe race. Twenty-five racers signed up and 22 started. This race is a flat-out, all-you-can-go speed race started from a standing start and flown around a triangular course, finishing over the start point in flight (not including the landing).

This race used to be strictly for EZs, but has been expanded to include this year, Glasairs, a Lancair, a White Lightning, Cassuts, RV's, T-18, TC-2, etc., etc. Not surprisingly, the fastest airplane around the course was the 300hp Glasair III, turning in an average speed of almost 267mph! He beat the White Lightning by more than 10mph. The fastest EZ, Klaus Savier's VariEze, turned an almost unbelievable 219mph! We understand that Klaus has "breathed" rather hard on his Continental O-200 and it now puts out 145hp! Klaus was only 1mph slower than a turbocharged 180hp, retractable gear Glasair with constant speed prop!! And Klaus' VariEze has fixed main gear and a fixed pitch prop! The fastest "stock" Long-EZ was 171mph, the fastest "stock" VariEze was 196mph. A Long-EZ with a 160hp Lycoming engine turned in a speed of 206mph.

Congratulations to all for an excellent, safe race this year. For those who missed it and would like to try, start planning now for next year.

DEFIANT NEWS
Congratulations to Dennis Riehm of Bowling Green, Kentucky, who recently completed and test flew his Defiant. It took Dennis only 28 months from start to first flight. He has two Lycoming O-360, 180hp engines and has fitted them with two Great American fixed-pitch, wood props. Says it gets off and climbs like a rocket but, so far, he is disappointed in top speed.

How about you Defiant builders/flyers out there sending in a short note giving a brief summary of performance such as top speed and RPM at 8000ft at full throttle (approx. 75 percent power), approximate take-off distance, and approximate rate of climb? Also, state which engines and props you have and we will compile a summary and print it in the next CP. It would be helpful to everyone who is building a Defiant.

As we reported in the last CP, Don Foreman in England was having trouble getting his Defiant signed off by the English equivalent of the FAA. They finally told him the only way they would sign it off was if it was static loaded to 4.5 G's. We at RAF supplied the static load schedule. The English "FAA" disagreed with our data - and, anyway - to make a long story shorter, after several iterations of data exchanging, Don flipped his Defiant over and got it all ready for the static load. Solid lead bars were used to load the aircraft and these were stacked on top of each other at high as 5 or 6 layers as required. Then, they were tied together in bundles, as well as tied to the wings, to keep them from slipping as the wing or canard bent under the load.

This caused the "top" of these stacks of lead bars to swing outboard of the "bottom" of each stack of lead as the wingtip bent down. This, or course, increases the static load since gravity always works straight down.

Anyway, the outcome was that the main wing came through the load test with flying colors, but the canard, unfortunately, suffered a compression failure in the top skin at B.L. 110, right at the outboard tip of the elevator. This only occurred on the left side, the right side was not damaged.

We were not present at the time so are not really able to say exactly what may have caused this failure. It could have been simply an overload. It could easily have been a tiny wrinkle in the top skin or a small bump in the skin. It could have been damaged during the sanding/contouring/finishing stage. There are only three plies of UND in this area and the loss of some of the top skin, locally, would result in just such a failure. Post-test analysis of the area indicated that, in our opinion, a structural beef-up is required. We are making the following repair a mandatory change. Limit any flying Defiant to 2.5 G maneuvering load factor and reduce maneuvering speed (gust penetration) by 10 knots until this is done.

In a new-construction Defiant, this simply means that you must layup your canard top skin per plans then add two more plies of UND spanwise as shown, on the top skin only.

In an already finished Defiant, you will have to very carefully sand all paint, primer and micro off until you have bare glass in the area shown. Be careful not to sand into the glass - it is your structure. Now, layup two plies of UND spanwise as shown, and fair them in with micro and refinish. There is no requirement for any additional structure on the canard bottom skin. This repair must be done symmetrically, left and right sides of the canard.

This is the repair Don Foreman is doing on his and, of course, he will be required to demonstrate the static load again.

It's almost that time of year again - in our opinion the most fun fly-in of the year the:

1987 JACKPOT FLY-IN PROFICIENCY RUN
Coordinated by
Rutan And Composite Enthusiast, Shirl and Diane Dickey

LOCATION: Jackpot, Nevada (extreme NE corner of state)

DATE: July 3, 4, & 5, 1987

AIRPORT: Jackpot, NV. Elevation: 5217'. Runway: 15-33, 6000x60, new asphalt. Location: Adjacent to town. Fuel: 100 & mogas.

CAMPING: Camping is available including restrooms and showers.

LODGING: Cactus Pete's Resort Casino, $38.75 plus tax per night. Advance reservations required, call 1-800-821-1103. Please reserve early.

RECREATION: Tennis courts, swimming pool, golf course, gambling, live entertainment and restaurants.

SPECIAL EVENTS:

1. THE JACKPOT 120 PROFICIENCY RUN. This event is designed to eliminate all the bull about who's the most proficient. This year the run will be over a new triangular course to improve safety. The distance will be approximately 120 statute miles. Scoring is based on elapsed time only.

Cactus Pete's Casino is donating $1800.00 to our event again this year. Classes will be the same as in the past:

Stock VariEze	Up to 205 CID, no airframe mods.
Stock Long-EZ	Up to 240 CID, no airframe mods.
Unlimited EZ	All other EZs.
Exhibition class	Open to all single engine homebuilts

Prizes will be paid through 5th place as follows: 1st 40%, 2nd 30%, 3rd 15%, 4th 10%, 5th 5%. Entry: $10.00 per class.

2. RIBBON CUTTING CONTEST. Two ribbon drops each, total cuts wins. Prizes: 1st 50%, 2nd 35%, 3rd 15%. Entry: $10.00 each.

3. SPOT LANDING CONTEST. Two attempts at a chalk line. Winner takes all. Entry: $10.00.

4. DINNER SHOW. Friday, July 3 from 7:00 to 10:00 pm in the Gala Room at Cactus Pete's. Live entertainment and dinner.

5. AWARDS BANQUET. R.A.C.E. has reserved a private banquet room at Cactus Pete's on Saturday night, July 4. Time: 6:60 pm. Trophies and prizes will be awarded after dinner.

COME ONE, COME ALL - YOU'LL NOT BE DISAPPOINTED - ALSO SHIRL AND DIANE ARE PLANNING TO ORGANIZE ANOTHER "WENDOVER", NEVADA FLY-IN. PROBABLY IN SEPTEMBER, LIKE LAST YEAR.

BRUNO AND NATHALIE GUIMBAL
Many of you who attended Oshkosh 1986 will recognize these two names! Nathalie and Bruno are a young French couple who loaded their VariEze on a Boeing 747 in France and off loaded it in Miami. They then proceeded to fly around the United States, taking in the Centennial celebration of Lady Liberty in New York, the Grand Canyon, Mojave (yah!), Oshkosh '86, etc. They put 75 hours on their beautiful little EZ, landed on 32 different airports in 22 states burning 325 gallons of gas, for an average fuel burn of 4.3 gallons per hour!

Since returning home to France, Nathalie has given birth to a baby boy and she tells us he already has over 100 hours of flight time in the EZ! Their VariEze weighs 606 lbs, pilot plus passenger(s?) weighed 260 lbs and they packed in and carried 126 lbs of baggage!!

Bruno had some very neat ideas in his VariEze, not the least of which is a very clever electric roll trim and pitch trim system that is light and simple and has operated perfectly for over 800 hours! Bruno is a

very sharp engineer who has currently designed and is building a one of a kind helicopter (to carry 3, we wonder?). He sent us a sketch of his trim system and we would be happy to send a copy to anyone who wants it. Send a self addressed return envelope.

Thank you, Nathalie and Bruno for spending a little time with us last year, we enjoyed you and hope to visit with you some time in the future.

FIRST FLIGHTS
Congratulations to all of you who have reached the major milestone of first flight. Although we no longer hear from everyone who get this far, we hear from enough of you to know that there are a lot of new VariEzes, Long-EZs and even a few VariViggens, a couple of new Defiants and even a Solitaire.

It sure is great to hear that so many of you have achieved what must be one of the notable achievements of one's life, the building and flying of a machine that one has crafted with one's own hands. The first flight is the culmination of this experience and, for all of us, is a tremendously exciting and sometimes nervous time. When this time arrives for you, how can you be sure you really are ready? How can you be sure your flying machine is ready? We have always believed that the pilot must be current, must be proficient in at least two different airplanes, preferably three, and must be rested, relaxed and feeling good before he or she ever attempts a first flight on a brand new airplane.

Current means just that. You are presently flying something, be it a Cessna 150 or a Beech Bonanza, it does not matter just as long as you are, or have been recently, flying something. If at all possible, fly another example of the type to be tested. It is dangerous to combine a first flight in a new airplane with a pilot who has zero time in type. If something is unusual, he doesn't know if it's an airplane problem or his proficiency. If you have not flown for a year or more, do not even consider doing your first flight until you have taken a check ride in several types with a good instructor.

Tell him what you are about to try to do and have him really put you through a thorough proficiency check. Have him particularly concentrate on landings, balked landings, approach too slow. approach too fast - how do you handle it? Be as conscientious as you can, ask a lot of questions, be very sure you are feeling good, feeling confident in your abilities.

Now go out and check out in a Grumman TR-2, two place trainer or a Cheetah or a Tiger. When you feel good in this, then try to get a check out in some kind of a taildragger. A Champ or Citabria, or even a J-3 Cub would be good. It's not that you need taildragger skills to fly an EZ, but being proficient in a taildragger simply makes you that much more proficient overall.

Now you are ready, but is your newly completed airplane? The more pairs of eyes that look at it, the more likely you are to get everything the way it should be. Remove the cowlings, canard and nose cover. Invite the local EAA chapter to have their meeting at your home and have them all look at it. At least, try to recruit a couple of EZ

builders to look at it. Concentrate on the control system. It is simple, functional and trouble free, but all the bolts must be tight, safetied, and have two threads beyond the lock nuts. Does the stick move freely to all limits without any friction? Friction in the pitch control will make the airplane very twitchy and difficult to fly. Friction in the ailerons (lateral control) will make the airplane unpleasant to fly because you will not know if you are pushing or pulling against control system friction or against aerodynamic loads. This makes it awkward and not much fun to fly. It really is a truly delightful airplane to fly if it has a nice friction free, precise control system. Of course, the rudder should snap back into the faired position after rudder pedals are depressed then released (they should also do this in flight! If they don't, this condition must be corrected). Also, be sure the elevator shape and canard slot shape is exactly the same as the check templates in the plans. If in doubt, take a "splash" of the surfaces, send a drawing of the splashed shape to us for comment before attempting to fly. Small differences in slot and elevator shape can have large effects on the safety of your airplane at low and high speeds.

The next point to concentrate on is the fuel system. Fuel lines should be fireproof and there should be no leaks of any kind, even with the boost pump running. Flush the whole system several times with gasoline. Clean all screens/filters. Check that all nuts and bolts on the engine, baffling, and exhaust system are tight and safetied. Be sure the prop bolts have been torqued correctly, and re-torqued at the specified intervals.

The engine controls are a critical area. You will need help to check these out, and they must be right! Check the throttle, mixture and carb heat for full and complete travel. The throttle and mixture must travel stop-to-stop smoothly with no tendency to hang up.

If anyone looking at your project spots a discrepancy, write it down. Make a list of these discrepancies no matter how small they might be. Do not fly unless all items that could compromise flight safety have been taken care of. This applies throughout the flight test period and indeed, the life of the airplane, but is particularly important for first flight. You will be nervous, you will be excited. This is normal. If you have taken care of your proficiency and your airplane's readiness, your first flight will be uneventful, safe and a memory that will last forever.

VARIVIGGEN NEWS

Surprisingly, there have been three new Viggens take to the air in the past 6 months or so. Emerald and Reggy Ullman have their Viggen flying in Hillsboro, IL. Orv Winfield of Bristol, WI has finally got his beautiful Viggen flying and reports that it flys as expected with no problems. Wendell Hanks of the Los Angeles area in California has completed his, and since he was not current and proficient, he had a friend, Les Glenn (also building a Viggen), do the first few flights. Congratulations to all. That makes a total of 22 Viggens that have been completed and flown, at least, that we at RAF have been notified of. We know of at least one that is essentially ready to fly, George Craig in San Jose, CA. So how many will fly in to Oshkosh? Always the big question. To our knowledge, there has never been more than 3

Viggens on any airport or in the air in formation at any one time. Maybe at Oshkosh '87 we will see this record broken.

BUILDER HINTS
We recently worked with Bob Callender of Barry Controls regarding the vibration isolators (engine mounts) for three different engine installations including Mike and Sally's Long-EZ. Mike is very, very pleased with the Barry mounts and reports a noticeable decrease in vibration/noise and a marked improvement in smoothness throughout the RPM range.

Barry wrote us a letter in which he has shared some pearls of wisdom. Since he is an expert in the field, we have printed his letter below. For special or problem installations, contact: Barry at 818-843-1000.

"Dear Mike:
I hope by now you've had a chance to flight test your EZ along with the other installations Barry sent you parts for. I'd like to review your findings someday.

As we discussed, there are some facts and "general" rule of thumb guidelines to be aware of and follow regarding the use of engine vibration isolators.

Normally, each engine, propeller and truss combination will have a unique vibration signature and natural frequency. A change in any one of the three will change the vibration characteristics of that installation.

Under perfect conditions, the elastomeric "mounts" or vibration isolators are designed to suit these individual combinations on a installation-by-installation basis. Choice of elastomeric compounds and spring rates (stiffnesses) are also determined by the overall flexibility matrix of the individual installation.

Just because an isolator physically fits an installation envelope and related mount hardware doesn't necessarily make it the proper part.

So much for perfect conditions!

The real world (especially homebuilts) requires a combination of best effort and budgetary restrictions when choosing a suitable isolator. The best starting point for most installations is to use the same or cross-referenced equivalent isolator as used in the aircraft the engine came out of (especially if it's a factory airframe). Another choice is to find a factory aircraft using that engine and use isolators normally installed on the chosen aircraft.

New isolators should have current cure dates less than one (1) year old to ensure best performance. Ambient air alone will cause elastomers in installed isolators to lose their resiliency and deteriorate. Once the isolators are installed, they need to be inspected for wear and fatigue at the same time as other external engine parts.

Isolators should be kept free of dirt, oil and other petroleum based fluids at all times. Oils will soften the elastomer making them ineffective. Spilled fluids can be cleaned off using isopropyl alcohol or electronic contact cleaner.

Prolonged temperatures over 200 degrees will dry out and harden most elastomers over time. Heat will initially cause the elastomer to soften and "drift", but will eventually harden it, making the isolator ineffective. Extreme ambient temperatures during tie down and storage are just as destructive to the elastomer, and contribute to short service life.

Isolators should be changed every time the engine is removed from the airplane. They will take a permanent "set" within 48 hours of installation and are virtually impossible to replace in an identical fashion.

Wear for installed isolators varies with flight hours, and is not consistent from aircraft to aircraft. Each inspection should include looking for debonds and tears in the elastomer.

Debonds are a physical separation of the metal outer or inner plate from the elastomer. A good rule of thumb is 30 percent circumferential or 30 percent depth separation.

Tears or splits will show in the bulged or center portion of the isolator and follow the same rule of thumb. They should not exceed 30 percent circumferential, 30 percent elastomer depth or 30 percent elastomer width separation. Any one of these conditions is cause for replacement, at which time all isolators should be changed. Equal spring rates and loads are essential to proper isolator performance.

Since no two installations are identical, and aircraft hours per year are so different, service life is reflective of those conditions. At very best though, five year old isolators or installations should be changed out. Other items for inspection include excessive deflection, mounting bolt integrity, security and tightness.

Mounting trusses should be made as stiff as possible. This normally allows a "softer" ride. Full ringed trusses are best. They also keep engine deflections to a minimum. The "horseshoe" type trusses are very flexible, and usually require stiffer isolators. This in turn allows more engine deflections, that require larger cowlings.

Actual truss members need to be checked during installation for non-concentric bolt attachment and engine mounting flange points. When a truss "leg" or member is pre-loaded during installation to center the bolt or isolator, undue stresses are put into the isolator that can cause it to prematurely fail. Be sure to look for this especially on rear mounting engines without a completed truss ring at the isolator mounting plane.

We have an 0-200 isolator configuration in place on Bruce Evans' EZ, and have an installation in the works for an 0-290. I'm gathering data and will keep you informed. So far, Bruce seems very happy. Sketches showing the modifications are available if you would like to publish them in the Canard Pusher.

If you have any question, or if any of your builders have questions on engine isolators, don't hesitate to contact me.

Regards,

BARRY CONTROLS
A Unit of Barry Wright

Bob Callender
Sales Engineer
Engine Vibration Isolators"

CONTROL SURFACE BALANCING
We have published this before but since it's one of the most common problems we get calls and letters about, here it is again!

First of all, your ailerons, elevators and rudders can be very thoroughly sanded, far more so that the rest of the aircraft. Use a blue foam (Styrofoam) block, sized to fit your hand, and a half sheet of 40-grit sandpaper. Sand vigorously the top and bottom skins of the control surfaces, particularly toward the trailing edges. You can safely sand off up to 50 percent of the top ply of UND - this leaves one and a half plies of UND - more than adequate for control surfaces. What it does is reduce the weight of these parts considerably, especially aft of the hinge, which makes it much easier to balance and ,more important, since it is now very smooth it takes much less fill and paint to finish the part, making it easier to balance. Using this method, and assuming reasonably good workmanship, it should be easy to balance your elevators. Elevators absolutely must be balanced per the plans criteria or they will flutter! This means they must balance after finish.

Ailerons are not as critical due to the much stiffer wing they are hinged to, but even though we have not had a single case of aileron flutter reported, you should still be sure to balance them within the plans criteria. If after sanding them thoroughly as called out here and checking to be certain that the mass balance is correctly positioned relative to the hinge, they still don't balance, the best method of adding mass balance weight is to go to your nearest golf pro shop and purchase a roll or two of soft lead ribbon used by pros to weight the heads of their clubs. This is a 3M product and consists of a roll about 1/2" wide of lead ribbon with a sticky back. Stick it on top of your existing steel rod mass balance, as far forward as possible without increasing the chord of the ailerons. Stick it on the full span. Use as many layers as it takes to balance within the criteria, then lay up one ply of BID over the lead to permanently attach it to the aileron.

EZ type rudders do not require balancing, however they can benefit from a thorough sanding because it will take less fill and paint to finish and therefore, they will be lighter. As far aft on the aircraft as the rudders are, excess weight here is hard to take care of.

This is the method we have used for many years here at RAF and it works well. In about every case, the sanding alone will balance the ailerons

and elevators without any additional lead. At least, this has been our experience.

NOSE GEAR/NG-15 CASTING ATTACH
The NG-15 casting is attached to the bottom of the glass strut by potting it in flox and bolting it on with AN525-10R24 screws through a 1/8" thick 2024T3 aluminum plate - (see page 13-9). While these screws can easily handle normal landing loads, a very hard landing may pull the heads off these screws. Several builders have reported to us that this happened to them. The solution is to substitute AN3-14A bolts which can handle a much higher tension load.

BRAKE LINES
As mentioned in CP49, page 7, Mike and Sally installed Teflon hose assemblies (Stratoflex part #124001-3CR) in place of the Nylaflow nylon brake lines. These Teflon hoses are constructed with a seamless, smooth-bore, Teflon inner tube wrapped with braided stainless steel cover. These hoses come made to length with the ends swaged (not reusable ends) so must be ordered the correct length to suit your particular airplane. They are not cheap but should last the life of the airframe. Mike and Sally ordered theirs from Aircraft Spruce and the cost was approximately $42.00 per 40" length. These hoses come with a certification tag on them certifying that they are good to 1,500 psi. Mike installed them from the brake calipers to the master cylinders in one piece, mainly to avoid any more joints than necessary and to help eliminate any place for a leak to develop. The smallest hose available in Stratoflex is a -3, so you will have to use -3 elbows and nipples. For example, at the caliper, Mike used AN822-3D elbows and AN816-3D nipples on the master cylinders. The stainless wrapped Teflon hoses were inserted into a hardware store plastic tube (split the plastic tube lengthwise) then Hot Stuffed to the main gear strut trailing edge. One ply of BID was layed up over the plastic tube to permanently hold the new brake lines in place.

With over 200 hours on their Long-EZ since installing these brake lines, Mike reports that he is one hundred percent satisfied with their performance, and it was well worth the higher cost. While he was at it, he disassembled his master cylinders and installed all new "O" rings, cleaning the parts in denatured alcohol. The calipers were cleaned up and new "O" rings installed. Dot 5 brake fluid, a 100 percent silicone brake fluid (a General Electric product purchased at a local hot rod auto parts store), was used and Mike does recommend it since it is completely inert and therefore non-flammable. It does not affect seals, "O" rings, paint, or hoses so there has been zero maintenance on their brake system and we are in the process of installing the same system on Burt's Defiant, N78RA.

Be sure to measure your own airplane to get the Stratoflex the correct length for your aircraft. If you have brake master cylinders up front, as many builders do, you can either run the Stratoflex lines all the way (probably best, but expensive) or you can run the Stratoflex up each gear leg and then go with Nylaflow or Nyloseal from there. It will take an AN910-1D coupling (1/8" pipe thread) together with an AN816-3D nipple and a 268P male connector on each side.

EXHAUST SYSTEMS
For Long-EZs we have used the Brock prefab, plans-type stainless exhaust header with "ball swivel" joints. On the prototype, as well as Dick Rutan's and Mike and Sally's Long-EZs (well over 3,500 hours total time), we have never had a single problem with this setup. For VariEzes, we have always recommended this same system for Lycoming O-235 powered EZs' for Continental O-200, we recommend the exhaust system originally designed, fabricated, and sold by VariEze builder, Herb Sanders, through his company, Sport Flight.

Generally, we have had very little trouble with either of these systems. In the interest of cooling the engine, we have always recommended a rather small clearance hole around each exhaust pipe where it goes through the cowling. Recently, we were testing another system consisting of four separate exhaust headers that exit the cowling two on each side, one on top of the other. We wanted to see if there was any power advantage using four headers instead of a two-into-one system. In fact, there is a small power gain, between 50 and 75 RPM at full throttle at 8000 feet in level flight, but that was not the interesting discovery. During the testing, we simply cut enough cowling away that the exhaust did not touch the cowl. We inadvertently cut more cowling away than we had intended, and during the flight, we noticed a considerable drop in cylinder head temperature! Yes, lower CHT's, in spite of a relatively large leak in the pressure cowling. We sealed up the leak using engine baffle neoprene/asbestos glued to the cowling and fitting almost perfectly to the exhaust pipes. The CHT's went up higher than ever! We cut away the neoprene a little at a time. The more we cut away, the larger the high pressure air leak, the lower the CHT's became! We ended up with a full 1/2" of clearance between the cowling and the four exhaust pipes. Amazingly, this amounts to about 7 square inches of "leak" area on each side of the cowling! In spite of this leakage, we have excellent cooling.

How could this be? Perhaps the leak so far aft, even aft of the engine, gets the cooling air mass moving aft at a fairly high velocity then, of course, all of the incoming cooling air cannot escape out through the "leak" area, so it has to go through the cylinder cooling fins just as the engine baffling intended it to. For whatever reason, this does work, and not on just one airplane. We know of at least 3 EZ owners who have tried opening up the clearance holes around the exhaust pipes and they saw the same results - cooler cylinder heads!

PROP BOLT TORQUING
Some builders seem to think that by "overtorquing" their prop bolts they can get around having to check the torque. This is simply not true. There is no way around the fact that you have to periodically check your prop bolts for correct torque. Overtorquing makes no sense and can crush the prop hub over a period of time until the bolts run out of thread and bottom out! Very dangerous since you are not now gripping the prop! Your prop, once badly crushed, may not run true anymore leading to vibration. Also, it is possible to ruin the threads in the drive lugs. The correct prop torque value for 3/8"-24 bolts is 200/250 inch/pounds (18-20 ft/lbs) for any 5 laminate wood prop, and 300 inch/pounds (25 ft/lbs) for the new multi-laminate wood props.

For Defiants and those using the 7" diameter flange with 1/2-20 bolts, we have used 400/500 inch/pounds (33/42 ft/lbs) with no sign of crushing the new multi-laminate props. Even so, you still have to periodically check your prop bolt's torque. This is true whether you fly a factory built Champ, Cub, or whatever. If it has a wood prop, it must be checked every 50 hours or so. If you move from a wet climate to a dry climate, check it more often.

NOSE GEAR CARE

We recently replaced a nose gear shock spring on our Long-EZ (Brock part #LST-6) and were amazed at the difference. We had noticed that while taxiing, the strut would flex off the stop. The spring very slowly loses its capability to support the nose and, over a couple of years, insidiously, this condition gets worse and worse until you are taxiing nose down a few inches. It happens so gradually that you may not notice it. In fact, since we replaced ours, we have been noticing quite a number of Long-EZs that fly into Mojave are taxiing "nose low". If you have noticed that your nose gear rides on the spring as you taxi on a smooth taxiway, chances are you need a new spring.

Shimmy dampers! This has been by far the most frequent maintenance item on the EZs. The problem is that unless you keep your shimmy damper in perfect adjustment, the results can be a broken nose wheel fork. We recently installed an innovative shimmy damper designed by Bob Davenport onto two Long-EZs here in Mojave and so far, the results have been excellent. Bob has gone out and found an excellent machine ship to produce the few parts required to make this shimmy damper a bolt-on kit. Bob's kit is complete and includes stainless steel Belville washers (which provide the spring pressure), the threaded shaft, and all necessary washers, the nut and cotter pin. We have noticed a marked improvement in several areas. There has been no need to adjust it in over 3 months - about 50 hours of flying time. When the nose wheel touches down, it does not move at all when viewed through the little plexiglass window, whereas the original damper always allowed the nose wheel to shake side to side just a little at touchdown. Also, it seems, subjectively, to be easier and smoother to taxi and make turns using the brakes.

We strongly recommend Bob's shimmy damper for all Long-EZs and it will also work well on a VariEze (Paul Mason has been using one on his VariEze for almost two years with no problems whatever). Bob will sell you a complete kit including the drawings and instructions for $39.05 plus shipping.

Contact: Bob Davenport,
PO Box 650581
Vero Beach, FL 32965
303-567-1844

COMPOSITE SPINNERS - GOOD, OR NOT SO GOOD?

Mike obtained a Kevlar spinner a couple of years ago and has been running it on his Long-EZ, N26MS, on and off since then. At first it really seemed like the answer to crack-prone aluminum spinners but now, he is not so sure. This spinner was hand layed up inside a mold and looked like perhaps one ply of Kevlar and at least one, probably two or three plies of glass BID using Safe-T-Poxy. After several hours of flight, the attach screws were found to be

a little loose. They were tightened and were noted to have crushed the glass/Kevlar/Safe-T-Poxy locally. A month or two later, the same thing happened. This time, when the screws were tightened, they really "bit" into the spinner. To make a long story shorter, after several such iterations, several of these screws pulled through the spinner!

It was removed for repair before it left on its own! Carefully sanding the inside and the outside of the spinner, a uni-directional glass layup was vacuum bagged inside and outside the spinner. Again, Safe-T-Poxy was used and the spinner was post-cured at 250 degrees F for 2 hours. Much sanding and filling was required to make it fit the Brock spinner backplate/bulkhead and it never did fit as well or look as good again.

This time it lasted almost a year before the same problem occurred to the point where it almost departed the airplane! It has been removed and retired forever and Mike, at least, is very disillusioned about composite spinners. He is currently fitting an aluminum one.

Mike's theory on this is as follows: The screws are tightened and bite into the epoxy/glass/Kevlar and even crush it some. After all, it is not nearly as hard as aluminum. Then, after a flight, the Long-EZ is parked nose down. All the heat in the engine rises out of the back of the cowling and is conducted into the aluminum prop extension - and then into the spinner bulkhead. Feel it sometime ten minutes after you have shut down and parked! This heat then gets into the Safe-T-Poxy spinner and the Safe-T-Poxy softens, allowing the glass/Kevlar laminate to crush thus giving the appearance of loose screws! So we tighten them and the same thing happens. It takes a while, but after a year or less (250 flight hours) the screws are through the spinner and it can come off.

If you are flying one of these hand layed up spinners (obtained from Sport Flight when they were in Memphis), check it often and remove it if it is doing what Mike's did. Use large diameter Tinnerman washers to spread the load. Maybe what we need is a high technology, pressure cured (in an autoclave), high temperature, epoxy-type spinner. Until then, maybe the old aluminum spinner isn't dead yet!

INSTALLING TEFLON "SPAGHETTI" TUBING IN AILERON AND RUDDER HINGES
John Bingham, VariEze builder, suggests the following idea: Split the Teflon tubing as shown in CP39, page 7, then, using a needle and about 12" of strong thread, stitch the thread into the end of a piece of Teflon tubing per sketch. **SKETCH OMITTED**

Now, pull the needle through the aluminum hinge using a small magnet. Then, pull the thread at the same time as you push the Teflon tube through the hinge. While it is difficult to push the Teflon tube through the hinge, it is easy to pull it through! Thanks, John.

CAUTION! DO NOT CUT THROUGH ANY SPAR CAPS!! WE HAVE HAD SEVERAL BUILDERS WHO HAVE CALLED US FOR HELP AFTER CUTTING THROUGH A CENTERSECTION SPAR CAP! UNFORTUNATELY, THERE ARE SOME THINGS THAT ARE SO DIFFICULT TO FIX THAT IT IS EASIER AND QUICKER TO BUILD THE PART

OVER. THE MAIN PROBLEM IS IN THE AREA OF THE ACCESS HOLES FOR WING ATTACH BOLTS ON THE OUTBOARD END OF THE CENTERSECTION SPAR BOX. BE CAREFUL, GO SLOWLY AND BE CERTAIN YOU ARE CUTTING THROUGH FORWARD OF THE SPAR CAP! IT MAY SEEM BETTER TO HAVE THE ACCESS HOLE CLOSER TO THE WING, BUT IN THIS CASE IT IS NOT! LOOK AT THE PLANS IN CHAPTER 14, PAGE 9, SECTION C-C AND YOU WILL READILY SEE THAT THE ACCESS HOLE IS FORWARD OF THE SPAR CAP, THROUGH A RELATIVELY EASY-TO-CUT GLASS-FOAM-GLASS AREA. IF YOU CUT INTO THE SOLID GLASS SPAR, IT WILL BE VERY TOUGH TO CUT. IF YOU FEEL IT IS TOUGH TO CUT - QUIT! CHECK AND DOUBLE CHECK BEFORE PROCEEDING.

MIXTURE CONTROL RETURN SPRING PROBLEM

There have recently been two cases of engine failure resulting in forced landings (luckily without damage) caused by failure of return springs in the engine mixture control linkage. These, we believe, are due to improper installation of the bracket supporting the push/pull cable at the carburetor. The springs as properly designed are intended only to snub the system and improve the fidelity of the mixture control by eliminating free play. The springs should never be required to move the mixture control away from the idle cut-off position. In both instances, the springs had failed or lost their force due to fatigue and vibration. Properly installed, the swage at the cable end should sit very close (within 1/2") to the cable conduit clamp when the mixture is in the idle cut-off position. If your bracket allows excess exposed cable, then the mixture control cable may buckle rather than positively force the arm away from idle cut-off in the event of a spring failure. Do not depend on the spring to bring the mixture control into the mid range, well away from idle cut-off. If you do, the engine can fail due to a spring failure. If your aircraft does not pass the test shown in the plans changes section of this newsletter, ground it immediately and rebuild your conduit clamp so that the exposed cable is short, allowing the mixture lever to force the arm to at least mid range without assistance from a spring. This is required on the throttle as well as the mixture control.

VARIEZE FUEL TANK VENT

Recently had a report from a VariEze builder who was having terrible "overrich" problems with his new EZ. Every flight the engine ran so rich it required severe leaning to run smoothly. Fuel stains were all over the cowling and carburetor, pointing to a leaking needle and seat or a stuck float. Several calls later, after much head scratching, several mechanics had looked at it and given various opinions. The carburetor was completely overhauled and still, the fuel leaked all over the inside of the cowl!

Finally, on the phone, we decided that it was the fuel tank vent. It was installed so that it protruded out of the bottom of the fuselage into the airstream but, inside the engine cowling inlet! We were rather astonished by this but we are printing it here just in case anyone else may misinterpret the plans and install the tank vent incorrectly. If it happened once, it could happen again! Apparently, the suction of the cooling air entering the cowling sucked fuel out of the tanks through the vent and into the cowling, spraying fuel all over the carburetor and cowling leading this builder to suspect a sunk float or bad needle and seat. This was not only very frustrating for him, it could have been a disaster with all that fuel blowing around in the cowling near the hot exhausts.

We thank this builder for allowing us to print this story. Hopefully we can all learn a lesson here. On a VariEze, the main fuel tanks vent (which must be a common vent) protrudes out through the side of the fuselage under the right fuel tank/strake and faces forward at least 0.6" from the fuselage side and fuel tank bottom surface in high pressure air.

After he rerouted his vent into the correct position, this problem was completely eliminated and he is now enjoying flying his VariEze.

ACCIDENTS AND INCIDENTS

Long-EZ N218EZ: Incident Report
Scenario: I was the pilot in command of Long-EZ N218EZ at Scottsdale Municipal Airport when it crashed into a Cessna 152 after hand propping the engine. The situation occurred as follows: I had just fueled up for a local flight and was preparing the aircraft for engine start. I placed the wheel chock under the port tire and set the magnetos for ignition. I set the throttle position incorrectly although I did not realize this until it was too late. I then hand propped the engine and she started on the first pull but the RPMs were too high and the Long-EZ jumped the chock. I ran around the port wing but then my last failsafe malfunctioned. The rubber stopper under the nose, which was made out of a hockey puck, sheared off and the Long-EZ raced away toward the active runway. A previous gear up landing prompted the installment of a stainless steel plate under the nose in the event that a gear up landing occur again. The steel plate offered little friction to the asphalt and she accelerated away from me (I am slow of mind not of foot). I was only able to get alongside the

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wing at full sprint and the plane was still accelerating toward the active runway. I decided to try to alter the plane's course and at my last chance grabbed the port winglet and pulled myself up off the ground. Off balance, the Long-EZ did veer away from the runway but my troubles were just beginning. Now a less than willing passenger on the wing of a pilotless plane going approximately 25 mph, I helplessly watched as the Long settled on a course directly at a parked Cessna 152. I had no choice but to release and watch the planes collide.

Damage: The Cessna suffered a collapsed wing and sustained propeller, nose gear, and engine cowl damage. The Long lost the canard and punctured the port wing strake on the Cessna's propeller.

Recommendations: This situation arose primarily because the throttle was set at too high a power setting thus initiating the runaway condition. Second, the rubber stopper was made out of the wrong material (hockey pucks are designed to slide) and it was not secured to the fuselage properly. For those who hand prop their planes, I would recommend installing a parking brake and/or some remote cutoff switch for the engine. A simple procedural solution would be to set the fuel valve to off so that if the plane runs away, it won't get too far. Always be certain of your throttle setting. By Michael Best

I had an unfortunate accident to my Long-EZ in mid-January when as a result of heavy snowfall the hangar it was kept in at Biggen Hill collapsed on top of the machine. Estimated weight was around 100 tons! Much of this was taken on the canard - a girder across each side. One side was snapped off - the other side believe it or not when the weight was removed returned to its normal position. Other damage was a smashed canopy, damaged fuel tanks, undercarriage pulled forward slightly by the immense pressure. In addition, I had to saw off the top of one winglet above the rudder to release it. Plus some easily rectified damage to the other winglet. I was thinking of building a new canard anyway! Hope to be back in the air in a couple of months if everything goes well. by Robin Smith

Editor's note: This incident occurred in England at the famous World War II aerodrome at Biggin Hill. England had one of the worst winters in living memory in 1986/87. Another Long-EZ in the same hangar was also seriously damaged.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

VARIEZE PLAN CHANGES
MAN-GRD
Same as Long-EZ below.

LONG-EZ PLAN CHANGES

LPC #132, MAN-GRD
Inspection of engine mixture control system. Before flight, remove the cowling and remove any spring installed on the mixture control and the throttle control which is used to assist the control arms to go to the full rich or the full throttle positions. With the springs removed, pull the mixture control to idle cut-off and the throttle to idle, then push the levers forward and confirm that the mixture positively moves to least the mid range (well rich of idle cut-off) and the throttle moves to at least to two-thirds power without the assistance of any spring. Then re-install springs and put the aircraft back in service.

DEFIANT PLAN CHANGES
DPC #42, MAN-GRD
In a new-construction Defiant, this means that you must layup your canard top skin per plans then add two more plies of UND spanwise as shown, on the top skin only. In an already finished Defiant, you will have to very carefully sand all paint, primer and micro off until you have bare glass in the area shown. Be careful not to sand into the glass - it is your structure. Now, layup two plies of UND spanwise as shown, and fair them in with micro and refinish. There is no requirement for any additional structure on the canard bottom skin. This repair must be done symmetrically, left and right sides of the canard. **SKETCH OMITTED**

LIGHT PLANE MAINTENANCE is published monthly by Belvoir Publications, Inc., 1111 East Putman Ave., Riverside, CT 06878. Subscription is $72.00 annually, $6.00 per single issue. This is an excellent publication and, although aimed primarily at A&P mechanics working on factory built airplanes, there are occasionally articles that do apply to the engines and accessories we use. Gary Fisk was kind enough to sent us a list of potentially interesting articles for EZ builders.
Dec, 1986 - "Continental's O-200: An up-close look" by Kas Thomas - 6 pages.

Aug, 1986 - "Lycoming's O-235: An up-close look" by Kas Thomas - 5 pages.

Sept, 1983 - "An owner guide to TBO-Busting" by Kas Thomas, 5 pages.

Back issues can be ordered for $6.00 each plus $0.75 for postage and handling. We recently read the above articles and there are some excellent observations and helpful hints - we strongly recommend them.

SHOPPING
Aircraft Spruce and Wicks Aircraft both have in stock Cleveland wheels and brakes as follows: For VariEze and possibly very light Long-EZ - upgrade kit 199-93, includes a thick brake disc, but uses original 1-1/2" diameter piston in the brake caliper.

OR

199-156, includes wheels, thick brake discs and 1-1/2" diameter pistons and calipers.

FOR NORMAL OR HEAVY LONG-EZ

199-152, wheels, thick brake discs and large calipers with 2" diameter pistons. These give excellent braking capacity, even to a fully loaded

Long-EZ and this is what Mike and Sally have had on N26MS for over 2 years with excellent results.

Wicks Aircraft has, also, now got in stock the Facet fuel pumps with built-in 37 degree/3/8" J1C flare (-6 aircraft)
FP-40108 - 12 volt 6 psi
FP-480610 - 28 volt 6 psi (this part number was incorrect in CP50)

Wicks also stocks 1/4" x 3/8" O.D. x .035 wall stainless tubing for fuel lines. The plans call-out for Defiant pitot static has become so expensive in the order of $280.00!!) that we have approved the following "under wing" "L" shaped pitot statics:

AN5814-1 - 14 volt $165.00
AN5814-2 - 28 volt $165.00

Aircraft Spruce is now carrying the Braycote 601 fuel valve grease that Mike and Sally had. 2 oz. syringe cost $209.95 (enough to grease at least 20 EZs). They also have a new, economical flight warning system for gear or canopy warning. Please note that all EZ fiberglass prefab parts offered in the Spruce catalog are made by Larry Lombard and Michael Dilley of Featherlite, Inc., Boonville, CA.

FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete		$4360.00
Long-EZ gear strut		324.00
nose gear strut		55.00
glass engine cowling (top/bottom)		283.00
Kevlar engine cowling (top/bottom)		448.00
weight saved, approx. 6 lbs.		
cowl inlet (not used with NACA inlet)		30.40
wheel pants 3.5 x 5 set (used with Lamb tires)		131.75
wheel pants 500 x 5 set (used with cert. 500 x 5 tires)		155.25
NG30 cover (optional)		19.95
bulkhead kit (optional)		655.00
pre-cut foam cores (canard) (optional)		99.50
fuel strake leading edges w/bulkheads (optional)		499.00
strut cover - SC		17.85
nose wheel cover - NG		17.85
sump blister - SB (2 required)	each	17.85
Defiant main gear strut		756.00
Kevlar engine cowl set - front & rear		1488.00
Glass engine cowl set - front & rear		986.00
glass 600 x 6 wheel pants set (Kevlar on request)		175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.
Contact: Michael or Larry at: FeatherLite, Inc.
P.O. Box 781
Boonville, CA 95415
(707)895-2718

B&C lightweight Products - Bill Bainbridge
518 Sunnside Court.
Newton, KS 67114
(316)283-8662

We recently installed one of Bill's really fine LR-2 Linear Regulators (28v) and two of his 15 amp hour, 12 volt sealed batteries (never add water! - no drain required!) in our latest aircraft and, frankly, we are very impressed. We have, at times, cranked that aircraft engine (TIO-360, 210 hp, turbo-charged) for long periods with no sign of battery fade. The voltage regulator is the best we have ever seen and has built-in overvoltage protection. It also has a self-test feature and a low voltage warning light. Quality, as with all Bill's products, is truly superb. Bill's 10.2 lbs., 14 volt starter, of course, was the sensation of the show at Oshkosh last year and is really a fine unit. Fred Keller installed two on his Defiant and is very pleased with the weight savings and excellent cranking power. AVCO Lycoming is currently running an extensive test and evaluation on Bill's starters with a view of offering them on some of their engines. Bill is still working on the 28 volt model and hopes to have it available at Oshkosh 1987. Look for Bill and his electrical products in his booth (not far from the RAF booth) at Oshkosh this year.

Varga Enterprises
2350 South Airport Blvd.
Chandler, AZ 85249
(602)963-6936

Talk to George Varga. George was the original source for the heavy duty Long-EZ brakes and he reports that he now has complete sets which include heavy duty 500 x 5 wheels and bearing, heavy duty (3/8" thick) discs, and heavy duty (2" diameter piston) calipers. Kit part #199-152, complete for only $371.35. At this price you get the wheels for nothing! Good deal, George!

CANOPY GAS SPRING FOR THE DEFIANT
We reported in CP49, page 7, that a good gas spring could be ordered from the Gas Spring Co. and that the part number was FB22A(P1-60). Roger Rupp, a Defiant builder from Alaska, recommended this to us but has since determined that this gas spring is too strong and may bend your canopy crosstube. He has done some careful research and by trying several different gas springs, has come up with part #FB226(P1-40). Order it from: Gas Spring Company

92 County Line Road
Colmar, PA 18915-9607
(215)822-1982

See CP49 for more information.

CORRECTION - RETROFIT AILERON HINGE KIT
We received the following from Gary Hall after CP50 came out.

"My correct area code is (305) not (303) and the house number is 4784 not 4748. I've notified my neighbor and called Colorado. I explained to those nice people that they are going to get a few calls from a crazy group of people called experimental aircraft builders asking for Gary Hall. The RETROFIT AILERON HINGE KIT IS $21.00 and will be shipped UPS unless you instruct me to do otherwise. (Outside US - $25.00) The kit consists of Teflon spaghetti tubing and a special high grade stainless spring steel to fit inside the tube. If your hinges are "CLEAN" it will take you about 10 minutes per Long-EZ aileron to retrofit. The importance of this kit is to prevent any wear on the AL2 hinge. Teflon should last several years. This is how long Mike has had his in place and there has not been any wear. This kit will work on any Long-EZ, VariEze, Defiant or other aircraft using he MS20001-P3, P4, P5, or P6 hinge.

Gary Hall
4784 NW 43rd Street
Lauderdale Lakes, FL 33319
(305)484-4949 (home)

SOMETHING NEW FOR EZ BUILDERS by Rusty Foster
The Space Saver Panel has been modified to keep up with EZ builders' new ideas. The switches are the same, except for an additional radio master switch. The original Space Saver Panel had 13 circuits and a 30 amp main breaker to protect the battery. The modified Space Saver Panel has 17 circuits plus a 35 amp main breaker that protects the alternator to comply with the B and C alternator circuit. 6 of the circuits use auto-type (ATO) fuses. The only drawback I see with these type fuses, is the minimum size fuse they manufacture is 3 amp so this would mean in-line fuses below 3 amp. The warning system and fuel system circuits were purposely installed on the radio master buss to prevent electrical spikes if you are using the Ayton Warning system or the Act Easy Fuel level gauges. Another change is the addition of the 12 watt rheostat using up to a 12 watt lamp. You don't need much light if it is in the proper place.

Manhours for wiring is what made the original Space Saver Panel expensive. The new Space Saver is assembled for you and the buss work done. No terminal blocks are provided and none are needed (except for the ground buss). Run your wires direct to the panel and hook them up. Using shielded wire is really not practical (except for the mag. ckts) running your wires through a grounded conduit would be easier to do. The instruction booklet comes with each unit showing you how to wire the Long-EZ using the Space Saver Panel. You have a choice of black anodized or gold (it's more bronze than gold) anodized face plates.

If you are using Zolatone paint in the cockpit, you may want the unfinished Space Saver Panel. - 35 ampere $525.00

If you are using enamel in the cockpit, you may want the Gel-coat Space Saver Panel. 550.00

If you want the 60 ampere Space Saver add 25.00

If you want the Warning System installed, add 60.00

If you want the RST Voltmeter installed, add 40.00

If you want Special circuits - $20.00 per hour plus parts.

A $200.00 deposit is required (shipping and sales tax not included in the above prices). Allow 60 days for delivery.

Instruction Booklet	25.00
California Sales Tax	1.50
Shipping and Handling Charges	3.00
	29.50

Warning System Module only	20.00
California Sales Tax	1.20
Shipping charge	1.00
	22.20

Oil Pressure Module "B" only	20.00
California Sales Tax	1.20
Shipping charge	1.00
	22.20

The trend today is some of the builders are buying engines that came out of aircraft with 28 volt systems. Rather than change the system to 14 volt , it is an advantage to use the 28 volt system. For example, lets say you are using the 35 amp Space Saver 14 volt system. You have calculated your load to be 30 amps. Now without changing your load you decide on the 28 volt system. Your load then drops to 15 amps. Now you have two ways to go - one; you can reduce the wire size because you are not drawing as much current or, two; you can increase you load by 15 amps more. Most builders choose to increase the load. Another example, supposing you are using the 60 amp Space Saver 14 volt. You have calculated you load to 50 amps. Now you change to the 28 volt system, as before your load drops by one half or as in this case the load would be 25 amps.

The FAA acceptable methods manual, "EZ-AC 43,13-1A & 2A", provides us with a wire chart that shows a 12 ft run at 35 amps has to be #8 wire. A 12ft run at 45 amps has to be #8 wire. A 12ft run at 60 amps has to be #6 wire. 12ft is the approx. length from alternator to Space Saver Panel buss. A 14ft run at 10 amps can be #18 wire. A #6 wire 12ft long weighs 1.2 lbs. You can use 6-12ft lengths of #18 in a bundle for a 40 amp rating that weighs .4 lbs. For the 45 amp Space Saver, it would be better to use the #8 wire from the buss to the alternator and 4 #18 wires from the buss to the master relay (much shorter run). The load hog on the 35 amp 14 volt Space Saver and 45 amp 28 volt Space

Saver is the 25 amp 14 volt and 35 amp 28 volt electric heaters. Turn them off when preparing for a landing. The disadvantages of the 28 volt system are you will need a 28 volt to 14 volt converter for some of your electrical needs that are rated at 14 volts only. Also a voltmeter in the range of 0 to 30 volts is a must. Now if you have read this far, I think you can choose wisely the Space Saver Panel that is best for you.

If you want the 45 amp 28 volt Space Saver, add $25.00

If you want the 60 amp 28 volt Space Saver, add 25.00

If you want the cockpit light installed, add 25.00

The cockpit light installed in the Space Saver will provide enough light to read a chart and also can be directed on the airspeed indicator for monitoring airspeed at night. They were used in the Voyager for a primary source of light on its trip around the world.

Foster's Modular Design Co.
P.O. Box 1569
Portola, CA 96122
(916)823-5993

RAF SPECIAL OFFER
Thanks to the super response to the belt buckle offer in the last newsletter, we have exactly two buckles left - the only two Solitaire buckles to be had! Still at the special price of $10.00. First come, first served!

Summer's here and so this CP special is caps. We have VariEze caps, a limited number of Defiant and Solitaire caps. There are no Long-EZ caps available. Summertime special price, while they last! $5.00!

Aircraft Spruce,
P.O. Box 424
Fullerton, CA 92632
(714)870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
(618)654-7447

FeatherLite
P.O. Box 781
Boonville, CA 95415
(707)895-2781

Brock Mfg.
11852 Western Avenue
Stanton, CA 90680
(714)898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

FOR SALE

Lycoming 0-235-L2C - Remanufactured for Long-EZ, includes mount, exhaust, Great American prop and prop extension. TASK fuel/baggage strakes - $8,000.00 firm. (805)925-2870 - ask for Don.

Lycoming 0-235-L2C - 450 hours total time since factory new. Includes 3" prop extension, new Great American prop and spinner. This engine was on my Long-EZ and has been well cared for. The whole package for $5,700.00. Call: Dr. George Best

(602)991-0476

Lycoming 0-360-A1D - Disassembled but with new pistons, wristpins, rings, bearings, etc. Yellow tagged cylinders and carb. Magnafluxed, dye checked, etc. (papers available). Cost a lot more but will accept $5,700.00.
Contact: Bill Campbell
P.O. Box 253
Phelan, CA 92371
(619)868-6218

Lycoming 0-360-A1A - Low time, No logs, out of a Mooney - Bendix mags, no starter or generator, $2,000.00. Philadelphia area, will ship.
Contact: Bayard DuPont
New Garden Aviation
(215)268-8988

WANTED

One set of Paul Prout fuel gauges:
Call: Skip Morton
1199 Haceinda Avenue
Campbell, CA 95008
(408)730-6600 (days)
(408)379-1764 (eves)

Finishing my VariEze - need a Continental 0-200 or Lycoming 0-235. Either must have engine driven fuel pump. Price and condition is important. Contact: James Goebel
9 Georgia Park
Conroe, TX 77302
(409)273-2828

Bob Walmiller, while helping Joe Mullendorf and Claes Lundgren build their Defiant, came up with this simple method to eliminate the distortion that takes place when you cut BID glass then pick it up, carry it to your plane, and lay it on the foam. Thank you, Bob, for sharing this idea with us and for the excellent photos which so clearly show what is going on:

"TAPED-FIBERGLASS CUTTING TECHNIQUE
To minimize the distortion of fiberglass cloth when cutting, handling or doing a layup, place a 1/2 or 3/4 inch wide masking tape directly onto the cloth wherever a cut is to be made (1). The tape should be placed around the entire perimeter of the piece being cut out. After all the tape is in place, cut through the middle of the tape and the fiberglass cloth simultaneously. The presence of the tape allows the fabric to be cut more easily with either standard shears (2) or a circular "pizza" cutter (3). After the cut is made, the tape helps the fiberglass hold its shape while it is handled (4a). This is a big improvement over fiberglass without taped edges (4b). Likewise, the free edge of the fabric stock remains straight and will not unravel (5). This greatly reduces the amount of time spent straightening fibers before making a cut or during a layup (especially with BID).

Since the masking tape adheres to the fiberglass extremely well, many fibers will be pulled out of alignment if any attempt is made to remove it. Therefore, trim the taped edge from the layup after it is correctly positioned and still dry, then complete the layup as usual (6). It is not necessary to trim the taped edge anywhere it will be trimmed after the layup has cured, provided it does not interfere with good layup practices (7).

This technique requires very little time to implement and saves much aggravation during the layup."
Robert J. Waldmiller. **PHOTOGRAPHS OMITTED**

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

YEAGER AND YEAGER

An Australian Long-EZ panel by John Sabadina and Susan McQuillan

John L. Hayes taxiing out for first flight. All went well and John is very pleased with the results of his labors.

Long-EZ instrument panel by John L. Hayes of Euless, TX.

Norm Radtke poses with his beautiful VariEze at Fond du Lac, Wisconsin.

Sid Busby of Marlow, Buckinghamshire, England has 14 hours on his Long-EZ.

John Sabadian and Susan McQuillan with their newly completed Long-EZ at the Cairns International Airport in Australia

Nathalie and Bruno Guimbal with Burt outside RAF at Mojave - Neat little VariEze!

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

FIRST LONG-EZ IN INDIA
The first ever canard type, first composite type and first Long-EZ ever to be built and flown in India was completed and successfully test flown on February 26, 1987 in Bangalore, India, by builder R. B. Damania. Congratulations, a really fine looking Long-EZ judging from the photos he sent us. When you consider some of the bureaucratic problems some of our builders have to contend with, we have nothing but the strongest admiration for their tenacity and skill. It really makes us realize just how fortunate we who live in these United States are!

Cecil Cutting and his daughter. Pulling out of the bottom of a loop! Haven't we all done this?

Paul Siegal's Loran-C (King) and his fire extinguisher

Static load of Don Forman's canard. Just prior to failure.

Paul Siegal's Long-EZ instrument panel - neat!

Bayard Dupon's Defiant out at the airport in Toughkenomon, PA.

Don Forman's canard - failed at B.L. 110.

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GRAPH SHOWING CHRONOLOGY OF RUTAN-DEVELOPED AIRCRAFT OMITTED

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Burt's latest design, Model 144 (CM44UAV) was built in what used to be RAF, and made its first flight on February 27, 1987 with Mike Melvill at the controls. The aircraft is currently in flight test and will be delivered to the customer, California Microwave, in the next few weeks.
PHOTO OMITTED

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THE CANARD PUSHER NO 52 JULY 87

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 52. If you are building from 2nd Edition plans you must have newsletters 18 through 52. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 52. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 52. If you are building a Long-EZ you must have newsletters from 24 through 52. If you are building a Solitaire, you must have newsletters from 37 through 52. If you are building a Defiant, you must have newsletters 41 through 52.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please have your serial number ready. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

OSHKOSH SCHEDULE - 1987

Friday, July 31
9:30 am - Burt, Dick and Jeana at Theater in the Woods.

Saturday, August 1
9:30 am - Burt, Dick and Jeana at Theater in the Woods.
2:45 pm - Burt and Mike, Tent #3, builder support question and answer session.

Sunday, August 2
1:15 pm - Burt in Tent #2, "Chronology of the Rutan Aircraft".

8:30pm - Burt at Theater in the Woods, "The Voyager Story".

Monday, August 3
9:30 am - Burt, Dick and Jeana at Theater in the Woods.
2:45pm - Burt in Tent #2, "Forget Evolution for tomorrow's Light Plane".

In addition to the above schedule, RAF will be in the Wicks booth every morning from 10:00am to 11:00am to answer builder questions. As usual, we will also have pilot "bull sessions" every day at 1:00 pm under the wing of Burt's Defiant. These sessions are not for builder questions, but are used to discuss various experiences of builder/pilots actually flying RAF-type airplanes. RAF will have the usual #G-7 booth in the South display building. This booth will be shared with Larry Lombard and Michael Dilley of FeatherLite Products, Inc. Both of these guys used to work for RAF and both are very familiar with all RAF airplanes. They will have many of their products on display. Larry and Michael do all of the prefab composite parts for VariEzes and Long-EZs.

Many of the Voyager items - posters, etc., as well as our new poster, will be available at our booth.

DEFIANT REPORT
We requested in CP51 that all Defiant flyers send in a short note giving a brief summary of performance, top speed at 8000' at full throttle, approximate take-off distance, and approximate rate of climb.

We received one report, from Dennis Riehm of Bowling Green, KY. Dennis's Defiant will go 178kts (true air speed - 205 mph) at full throttle at 8000ft. Rate of climb will remain pegged at 2000ft/min through 4000 feet at 120 KIAS. "Flight characteristics are delightful, very, very stable, and it is easy to land. Pitch is more sensitive than roll but the plane is easily trimmed for hands-off flight." He has installed O-360-A1A(180hp) engines and is using Great American fixed-pitch, wood props.

Dr. George Best from Phoenix, AZ made his first flight on Friday, May 22, 1987 and he stated, briefly, in a phone call that he is happy with it. All systems are OK, temperatures and pressures were OK, and he is amazed how slowly it will fly on short final! He saw 168kts on his airspeed indicator at full throttle in level flight for a true airspeed of 191kts (220mph). George has Lycoming O-360 (180hp) engines with Hoffmann 3-blade, constant-speed propellers. Congratulations, George!

We have heard from two more Defiant builders who, at this point, have their planes in white paint and ready to go to the airport. They are Rodie Rodewald of Hawaii and Ted Rogers of North Carolina. There are nine Defiants currently flying that we know of.

If you are flying, please do send in the information we requested in CP51.

We were most pleased to meet Byrdell Mathews from Spring, TX at the Jackpot, NV fly-in. Byrdell and his wife flew up to Jackpot in their Defiant. Byrdell does not have wheel pants on his Defiant yet, so he does not have a good speed for us. Burt flew the prototype, N78RA, to Jackpot as well, so we had two Defiants to look at.

DEFIANT CANARD UPDATE
After the CP51 announcement of Don Foreman's Defiant canard failure in a static load test conducted for the British CAA, a couple of Defiant builders in Florida got together and decided to also do a static test on a spare canard they had.

Johnny Murphy, builder of a Quickie, a VariEze, a Long-EZ, an Adventure, a Glasair and a Defiant (to name only the composite airplanes he has done!), got together with Mike Cardinale, builder and flyer of a Defiant, and they decided to salvage Mike's canard that was damaged and rejected in a landing accident very early in his Defiant flying program. The canard was repaired and Johnny (who is a mechanical engineer) designed and built a steel support to adequately handle the expected static loads.

During one of this area's local EAA chapter meetings, the canard was static loaded according to the exact same instructions that we sent to Don Foreman in England. Unfortunately, because the canard was not mounted in a Defiant fuselage as Don's was, the attach taps on the canard were bolted to the rigid angle iron support jig in such a way that these lift tabs or main attach tabs "saw" an enormous side load instead of only a pure lift load as they were designed to do. As a result, one of the lift tabs failed at 5 "G" at which point the canard tip was deflected no less than 18"!, thus allowing approximately 2/3 of the load on the left side to be added to the full load on the right side - all of

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which was then successfully supported by the remaining lift tab which was now supporting the load as it should. Unbelievably, the remaining lift tab held this static load and also held the dynamic load as the left tab failed and the whole canard and load fell several inches until the left canard tip struck the ground. This dynamic load could easily have been double the static load, at least momentarily!

The interesting result was that this canard did not fail as Don Foreman's had, even though it was loaded to a higher static load and even though this canard had been rather seriously damaged in an accident and subsequently rather roughly repaired.

Johnny and Mike have informed us that they are planning to repair the lift/attach tab and hang the canard to let these lift/attach tabs "see" the load as they should, and do, in the aircraft. They then plan on loading it until they break it. They will collect deflection and "G" load data and we will present it here in the CP when it becomes available.

This data and the photos printed in this CP are presented to help builders of Defiants feel a little more confident in their structures, but RAF is not withdrawing the mandatory requirement for a 2 ply UND structural beefup as called out in CP51. This change still stands.

IVCHC 1987 OSHKOSH EAA CONVENTION ACTIVITIES

Saturday, August 1 - IVCHC Lady's Luncheon
Butch's Anchor Inn, 11:00 am to ?. Please let Bernadette know if you plan to attend.

Sunday, August 2 - IVCHC Social Hour
Free coffee and donuts (courtesy of IVCHC), 9:00 am to 12:00. Homebuilt Headquarters (Near EZ flight line and the main gate).

Monday, August 3 - IVCHC Oshkosh Banquet
Butch's Anchor Inn, 6:30 pm (no host bar), 7:30 pm (dinner), $14.00/person (current members), $15.50/person (non-members), (shrimp or prime rib), (Tickets may be purchased at the RAF Booth at Oshkosh).

IVCHC will reserve a block of rooms at the University of Wisconsin, Oshkosh once again for the "1988" EAA Oshkosh Convention. THERE IS NO CHARGE FOR THIS SERVICE - one night deposit, pay to UWO, is all it takes!

ROUGH RIVER, KY RESORT FALL FLY-IN
Springtime is the time to start making plans to attend the VE Hospitality Club Fall Fly-In at the scenic Rough River Dam State Resort, Falls of Rough, Kentucky.

Mark your calendar for Columbus Day week-end, October 16-19, 1987. Call early for reservations: 1-800-325-1713 or 1-502-257-2311. Be sure to ask for the IVCHC discount room rate!

We are now planning and would like to hear from you about activities, and to get a head count to give the lodge chef.

Some ideas are: square dance at the lodge, outdoor cook-out and camp fire. Steve Wright's tri-park air race, Mammouth Cave side-trip, river cruise, and pilot-builder forums.

For more information please contact:
Buzz Talbot
222 Sunshine
Bolingbrook, IL 60439

Include a SASE and receive a flyer and airport diagram.

CAFE 400 - 1987
Although no one from RAF went up to the race held at Santa Rosa, CA, RAF-type airplanes were rather well represented with four of the eleven finishers in the 2-Seat Experimental Race being VariEzes and a Long-EZ.

Experimental - Single Place

PLACE	A/C TYPE	PILOT	Speed	MPG	HP	SCORE
1	Quickie	Turner	118.0	65.95	30	1364141

Experimental - 2 Place

1	VariEze	Savier	187.5	36.95	100	2252109
2	Q-200	Sheehan	171.5	39.51	100	2193009
3	VariEze	Hertzler	149.4	45.04	80	2103623

4	Lancair	Neibauer	179.9	26.62	118	1568901
5	Falco	Hansen	184.0	24.90	160	1508985
6	GlasairIII	Klix	205.2	21.25	300	1475939
7	RV-6	Vanrunsven	174.5	25.76	160	1461169
8	Glasair	Powell	169.6	26.22	180	1435562
9	Clerity	Burton	170.8	21.39	160	1180728
10	Long-EZ	Ellison	182.5	19.88	160	1168080
11	VariEze	McPherson	142.6	28.04	90	1167567

The CAFE 400 event, of course, is strictly an efficiency run. Top speed is not even a consideration. Klaus Savier who won the two-place experimental class, not only has an extremely efficient little airplane, he also is unbelievably fast based on his times at Sun and Fun and at Wendover. Quite a remarkable achievement.

JACKPOT, 4TH OF JULY WEEKEND, 1987
This year this very popular fly-in once again broke records for attendance as well as speed. Last year 43 EZs flew in, this year an incredible 57 EZs were parked on the ramp and 116 guests registered for the banquet at Casino Pete's! The distances that some people flew to get to this fly-in were amazing. One Long-EZ came from Cape Cod, MA. Another from New York, yet another from Columbus, OH and one from Milwaukee, WI!

Almost everyone showed up on Friday, lots of them during a serious thundershower which dumped quite a bit of rain and some impressive lightning. Saturday morning was crystal clear with essentially no wind. Shirl Dickey, the race organizer, briefed the race pilots (a record field of 36) on the new race course, a triangular course to eliminate the danger of head-on traffic at the turn point. The distance this year was exactly 125 statute miles.

With no less than 17 airplanes entered in the "unlimited" class, Shirl decided to break these into two races with 8 and 7 airplanes. As usual, Bruce Tifft in his yellow VariLong (?!) was the starter and all the racers formed up on either side of him several miles from the start point. When he judged them all in a relatively straight line, he pulled up and away they went.

It is really fun to watch these airborne starts and quite amazing how straight the line of airplanes racing was. The most interesting race this year was undoubtedly the stock Long-EZ race in which 12 O-235-powered Long-EZs competed. An excellent start and an unbelievably close finish, with all airplanes finishing within 6mph of each other!

As usual, the events were well organized, lots of fun, and most important of all - SAFE. Shirl and Diane Dickey are the greatest. This was the fifth year that they have organized this fly-in and it just gets better each year.

This year we were very pleased to have Burt and Dick Rutan fly in. Burt brought his Defiant which he raced in the unlimited event. Dick flew in in his blue Long-EZ which has 1450 hours on it now. Surely the highest time Long-EZ in existence. Unfortunately, there were no Glasairs in attendance this year. The builder of the most perfect Midget Mustang (Grand Champ at Oshkosh 1983, N3X) you have ever seen,

was heard to say when asked where all the Glasairs were, "I don't know, I guess bad news travels fast"!

A great weekend, beautiful weather, a neat airport and many beautiful airplanes. Lots of hangar flying around the pool, frisbee games, spot landing contests, ribbon cutting (a roll of toilet paper thrown from a Cessna 152, and each contestant tries to cut it as many times as he can before it falls to 1000ft AGL - won by Dick Rutan with 7 cuts!). What more could a bunch of EZ builders/flyers want? One Long-EZ flew in on Sunday morning and this was a special moment because this was the Long-EZ which was heavily damaged in a take-off accident last year at Jackpot. While no one was

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seriously hurt, the amount of damage was very disheartening to this couple who had only just completed their Long-EZ. They took it home and Art Lazzarini tells us that his wife went to work on it, building a new canard, a new right wing, two new winglets and then got a new canopy. He says she did most of the work herself and they got it finished and put the first hour on it July 4th, then flew into Jackpot on Sunday morning, July 5th. Congratulations to the Lazzarinis. You guys have definitely got what it takes.

Here are the race results along with the results of the Spot Landing and Ribbon Cutting events. Why not try to be there next hear on July the 4th weekend, it is more fun than you can believe.

RESULTS OF JACKPOT EVENTS - 1987

Unlimited -	1st -	Mike Melvill	225.98
	2nd -	John Chambers	215.16
	3rd -	Burt Rutan	211.59
O-200 VariEze -	1st -	Joe Moore	196.41
	2nd -	Shirl Dickey	196.21
	3rd -	Gary Hertzler	193.38
O-235 VariEze -	1st -	Bob Paulson	189.74
	2nd -	John Lambert	171.53
O-235 Long-EZ -	1st -	Clayton Kau	182.12
	2nd -	Robert Campbell	181.96
	3rd -	Gus Sabo	181.14
Ribbon Cutting -	1st -	Dick Rutan	7 cuts
	2nd -	Mike Melvill	6 cuts
Spot Landing -	1st -	Mike Melvill	A tie at
	1st -	Dave Ronneberg	6 inches

Longest Distance - Peter Magnuson - 2040nm (2548sm)
Dennisport, MA (Cape Cod area)

WENDOVER - 1987 BONNEVILLE 125

Sally and I had not been to Wendover, UT before and we were looking forward to it. On checking the weather on Friday afternoon, we were promised scattered thundershowers along the route with up and down drafts over the ridges. Visibility was excellent with strong tailwinds at high altitude.

We departed from Mojave after work, lifting off at 5:10pm. We climbed steadily as we headed north over Red Rock Canyon into the Owens Valley. The China Lake Naval Facility restricted area was in the way of a direct flight so we flew to the northwest corner of this restricted area before turning slightly right for a direct course to the Tonapah VOR. This course also guaranteed that we would remain clear of the very large restricted area in Nevada. The view was breathtaking from the Long-EZ. On our left was the sawtooth ridge with the highest peak in the contiguous 48 states, Mount Whitney, reaching almost 14,500ft. On our right, the White Mountains reaching over 12,000ft. Crossing the White Mountains, at 17,500ft, breathing easily from our Aerox nasal cannulas, we had just over 200kts showing in the Northstar Loran for ground speed. Good tailwinds, spectacular scenery, glass smooth air - what more could you ask for?

We trimmed the old Long up to fly hands off and steered left and right by using weight shifting! This can only be done in perfectly smooth air. When we both moved as far left in the cockpit as we could and stayed there for a minute or so, the airplane would slowly come left. Move to the right and the left turn would stop. Really a neat thing to do.

We crossed Tonapah VOR and then headed directly to Wendover airport, using the Loran for navigation. The incredibly desolate desert country of western Nevada slowly gave way to some green ridged mountains covered in pine trees as we moved toward the Utah border. We had to dodge a few thundershowers and even got wet a few times, but it was an easy flight. As we let down towards the ex-military base of Wendover, we had several rainbows around us. The terrain of Wendover can best be described as looking like the surface of the moon! "Why would anyone want to come here", we wondered. We landed at 7:20pm, a two hour and ten minute flight, averaging 193kts (222mph). The advantages of an on-board oxygen system and flying high where the strong tailwinds are, were obvious.

There were about 15 VariEzes and Long-EZs on the ramp, but everyone was already in the motel. We got a short ride in the motel shuttle bus to the really nice looking Stateline Casino/Motel which is just a few feet over the Utah state line into Nevada.

Good company, good food, and a fun place with a beautiful swimming pool - that's why people come here! This is where the land speed records have been set over the years. The Bonneville Salt Flats! We were amazed to see that back in 1949, John Cobb became the first person to exceed 400 mph in a really special car called the Railton Special, 1949! Wow! Now the record is over 620mph on land. Incredible.

Early the next morning, Shirl Dickey, the host and organizer of the Bonneville 125, held a pre-race briefing and then we all were off. Bruce Tifft was the starter in his bright yellow, highly modified

Long/VariEze (?). The first race was the unlimited. There were six planes entered, 3 VariEzes, 2 Long-EZs and a Glasair.

We formed up, three on each side of Bruce, into a straight line as we approached the start point on the Wendover airport. Suddenly, Bruce pulled up steeply and we were off! I knew there was some fast competition so I pushed up the power a little and leaned to best power mixture. I looked at the other five contestants, expecting to see at least the 180hp RG Glasair going by, but no, they were all slowly falling back!

I let down to 5500ft MSL over the Salt Flats, noting that Shirl was right, the best emergency landing area was the blacktop frontage road south of the I-80 highway. I searched the eastern shore of the salt flats for the hill with the microwave tower which was to be our turnpoint. Still too far away, no, there it is, correct the heading a tiny bit, look back, can't see anyone. Where are they? Are they behind me? Are they under me? No way to tell. Here is the Microwave tower and there are Joan Hansen and Barbara Wilson in their yellow slickers. They're the turnpoint officials. I call that I am rounding the pylon and Joan acknowledges. As I sweep over them on my way back to Wendover, I hear the next arrival, the Glasair, calling his turn and I think, "Wow, maybe I can beat him". I concentrate on holding a dead straight line back to Wendover. I use the Loran as well as my map to be sure to fly the shortest possible distance. I notice that my ground speed readout is 13kts lower going West than it was going East. Drat! Must have a head wind. I push the power up a little more keeping a sharp eye on the temperatures and pressures. Everything is in the green but the oil temperature is higher than normal. I am back over the salt flats now and have the highway in sight. I am tempted to go down on the deck where I am sure the headwind is not as bad, but I figure that would leave me with zero options if I had any kind of engine problem. From 5500ft, I know I can glide to the road. I look around and see nobody! I wonder and worry if they are playing possum and sitting under and behind me in my blind spot. I begin to think that I might win! "Hold together for 13 more miles", I whisper to my trusty steed. I watch the miles count down on the Loran, when suddenly, Klaus calls a 2 mile straight in for the finish line! I am still 4 miles out but I can't see him. Then the Glasair and John Chambers announce they are 3 to 4 miles out. I start a shallow descent hoping to pick up a few knots, and call when I am at 2 miles.

Thirty-nine seconds later, I flash over the finish line. I'd won! Klaus was trying to psyche me out! What a neat feeling as I taxi in to see Sally smiling happily and walking out to meet me. Our Long-EZ performed flawlessly.

I stood behind Diane Dickey, the timekeeper, and watched the rest of the races. NEAT! You should have been there! It is really exciting when you hear the sound of EZs coming in over the salt flats, but you can't see them yet. Suddenly, there they are. "Who's in front?" Shirl Dickey and Joe Moore finish 1-2, so close it's hard call, only 1/2 second apart! Wow.

Four races were held, all were successful, all were safe and everyone enjoyed. That evening, at a really fine dinner in one of the banquet rooms at the Stateline, Shirl announces the results and presents the prizes. I win enough cash to buy a new volt/amp gauge I have had my eye on! Neat.

What a weekend, what a neat bunch of people, and what a neat place. We will be back next year! Hope this gives you a taste, an idea, of the fun that you can have with your EZ. Come next time. Shirl and Diane do a superb job of organizing a really neat weekend at Wendover as well as Jackpot, NV which is held over the 4th of July weekend.

Results of the 1987 Bonneville 125 (125 miles):

Stock VariEze (Cont. O-200)

Place	Name	Time	Speed (mph)
1st	Joe Moore	36:54:74	203.14
2nd	Shirl Dickey	36:55:29	203.12
3rd	Gerry Gardner	40:10:65	186.64

Stock Long-EZ

1st	Gordon Jones	40:13:07	187.41
2nd	Gus Sabo	40:13:18	186.47
3rd	Stan Snyderman	41:22:41	181.26

O-235 VariEze (New Class)

1st	Bob Paulson	39:29:10	189.94
2nd	John Lambert	39:42:25	188.88
3rd	Bill Lermer	43:45:95	171.33

Unlimited

1st(L/E)	Mike Melvill	32:29:45	230.80
2nd(V/E)	Klaus Savier	33:13:68	225.66
3rd(Glasair)	Ken Ashby	33:17:90	225.17
4th(V/E)	John Chambers	33:19:14	225.09

BUILDER HINTS

Heavy Duty Brakes
If you elect to install the larger brakes as strongly recommended in CP51, there is a possible problem to watch out for. If you have not installed the wheel pants, the easiest way to take care of the problem is to order two special steel spacers from Brock. The part number is A484-187. These new spacers will be installed on the axles first, then the main wheels will be installed normally. This will space the wheels 3/16" outboard.

If you already have wheel pants installed, watch for an interference between the wheel/tire and wheelpant. The amount of interference will depend on how tightly fitted your wheelpant is. The only alternative to this fix, which will not affect the wheel-to wheelpant fit, is to make new, longer locator pins and install them in the brake calipers. This requires some machining capability as well at lathe and thread cutting capability. We did go this route and we simply removed the locator pins by removing the nuts and pressing the pins out. We carefully measured these pins and machined up four new ones, but made them 1/4" longer. This will cure the potential problem without causing

any wheel-to-wheelpant interference, but is much more difficult to accomplish than the first option of using the two Brock spacer rings.

The reason for the above change is the possibility of the brake caliper locator pins pulling out of the fixed brake plate, thus allowing the brake caliper to rotate. This has already occurred in one case and it caused considerable damage to the wheelpant and the gear strut. Look carefully at the brake caliper and disc and you will see that as the brake linings wear down, the brake caliper will move inboard, away from the wheel and disc. If the brake linings are allowed to wear all the way down to the rivets, the locator pins may pull out of the steel bushings in the fixed brake plate. This is a real GOTCHA, so don't ignore it if you have the heavy duty brakes.

NOTE: This will not occur if you are still using the standard 500x5 Cleveland brakes. However, we feel very strongly that any Long-EZ should use the heavy duty brakes (part #199-152, see CP51) and even some of the heavier VariEzes probably should be using them.

Installing and Bleeding Brakes
We had assumed that everyone would know how to install and plumb the brakes on an EZ, and that everyone would know how to bleed the brakes. This has not been an area of great problems but has been an ongoing support requirement. Recently we saw a brake installation on a new Long-EZ that was done so as to make it extremely difficult, if not impossible, to successfully bleed the brakes.

First of all, when you receive a new set of Cleveland brakes, the brake bleeder fittings will almost certainly be installed into both brake calipers the same way. In other words, you may assume you have two left hand or two right hand brakes. No so! The bleeder fitting must be installed so it is on the bottom, or lowest point, on each brake caliper. You should never have a brake bleeder valve on the top of a brake caliper. So remove the one that will end up on top of the caliper and install it on the bottom, using teflon thread paste or tape. The 90 degree elbows should be similarly installed on the top of each caliper.

The brake plate, or brake caliper locator, a steel plate with a large hole in the center and 8 smaller holes punched around the large hole and with two steel bushings in it, should be slipped over the axle and should seat snugly against the axle flange. If it does not, which is quite common, use a file or a Dremel tool and radius the large hole in the steel plate until it will fit tightly against the axle flange. Choose the appropriate 4-hole bolt pattern (you have two choices) and bolt the axles onto your main gear strut. See CP34, page 11 for a clear photo of the left main wheel and brake on a Long-EZ installed correctly. Also see the sketch below. **SKETCH OMITTED**

Now, when you are ready to bleed the brakes, a really handy gadget is a Cleveland brake line bleeder tool (part #87-5) currently $21.30 in the Aircraft Spruce catalog. Install an 18" long flexible rubber or tygothane hose on this tool and connect the other end of the rubber hose to the nozzle of a large oil can with a trigger-type pump. Fill the oil can with Dot 5 automotive 100 percent silicone brake fluid, usually purple in color and made by most brake fluid manufacturers including GE which is the one we used. Now, remove the rubber bleeder

cap and install the 87-5 tool onto the brake bleeder valve. Using a 1/4" wrench, loosen the bleeder valve 1 to 2 turns. Pump the silicon brake fluid until the master cylinder reservoir is 3/4 full and tighten the bleeder valve (be gentle, this is a tiny little valve!). Remove the 87-5 tool and your brake is ready to fly. Since the whole system goes continuously uphill, there will not be any air in the system. Due to the small size and throw of an aircraft-type master cylinder, it is almost impossible to fill the brake master cylinder and line from the top as you would in an automobile. Using an 87-5 tool and filling from the bottom mounted brake bleeder valve, bleeding your EZ brakes is quite literally a 5 minute or less job. It helps to have an assistant watching the level in the master cylinder reservoir so you can quit before you pump fluid all over the place.

We highly recommend the 100 percent silicone brake fluid (must be Dot 5). Since it is completely inert, it is compatible with any type "O" rings and seals. It is not flammable and it does not destroy your paint as normal aircraft brake fluid does. We bought it at a Hot Rod-type auto parts store locally.

HIGH CHT'S

Recently we have had two separate cases where builder/flyers had been battling with really high cylinder head temperatures. Talking to them on the phone, we discussed baffling, cowling inlet and outlet sizes, carburetion, and spark plug heat range. Frankly, we, and they, were running out of ideas. Amazingly, both of these EZ flyers had obtained their engines in the same way, removed from a factory airplane with relatively low time and running fine when removed. As a result, both of these engines were installed in the EZs and flown as they were received.

The cause of the high CHT's was finally traced to one or both magnetos being timed too far advanced. In one case, one mag was timed 15 degrees ahead of normal. In the other case, both mags were 25 degrees too far advanced!! Beware, guys, some of the supposed FAA approved mechanics, A&P's and even AI's may not be any smarter than you are when it comes to timing magnetos.

In both cases, once the mag timing was adjusted to the normal position, CHT's were immediately reduced to normal. There is a lesson here. No matter where you obtain your engine, whether it is a factory new one, a rebuilt one, or a "used one running well when removed", check the timing before you go flying. If you don't know how to do this, get help from an experienced person who does. Assuming that the timing is correct could be a very expensive mistake.

PROP BOLT TORQUE PROBLEM

Long-EZ builder, Art Bianconi from Staten Island, NY sent in this hint. While he was torquing his prop bolts, he noticed a suspiciously high torque reading even though the bolt heads had not bottomed on the crush plate. Each bolt was an easy slip-fit in the holes in the wood prop hub and each bolt was an easy fit through the aluminum crush plate. On closer examination, Art noticed that the black anodize finish in each hole in the crush plate was worn off inside the holes, but only in one

spot, on the outermost surface of each hole. This indicated that the bolt circle in the crush plate was too small in diameter! He simply drilled each hole out .015" larger and that cured the problem.

It is possible that more crush plates like Art's are out there in the field, so if your bolts are tight, or even difficult to install through the crush plate and prop, take a look at the inside of each hole. If there is a polished spot on one side or the other, consider running a .015" oversize drill through the crush plate. It is very important that there is no such interference to give you a false torque reading on your torque wrench when you are checking your prop bolts. We appreciate this tip from Art Bianconi.

CRACKED WELDS IN EXHAUST SYSTEMS

We have heard of only one instance of cracks in a Brock Long-EZ exhaust system. It occurred at the flange where the pipe is welded to the flange. Careful inspection is necessary to find this type of crack. You may even need to lightly sandblast the area to detect these cracks. After these cracks were welded, there has not been any further sign of a crack but it is being inspected regularly.

There are several types of exhausts that are currently being used on EZs. Our own experience is limited to the exhaust systems made and sold by Ken Brock and to systems we have welded up ourselves. Exhaust systems, even on certified airplanes, are generally on-going maintenance problems. A simple, four separate pipe exhaust system we tried recently has been plagued with cracks. In fact, every time we have taken the cowling off, we have found cracks all the way from minor, little cracks to major cracks, all the way through one tube. So far, we have severely damaged the prop only once, when a rather large piece went through the prop, but we have been fortunate to catch potential problems before they became serious by careful inspection.

Any and all exhaust systems should be removed to be very carefully inspected at least every annual. If you have a history of exhaust system, cracks, check it every 50 hours.

The most reliable exhaust systems we have used on the VariEze were made by Herb Sanders of Memphis, TN, who sold out to Sport Flight which is now located in Florida. On the Long-EZ, by far the most reliable exhaust system has been the one made by Ken Brock Mfg.

CAUTION - WING ATTACH BOLTS

We recently heard from a Cozy builder who had been chasing a minor but annoying vibration in his aircraft for some time. He finally traced it to the fact that his wing attach bolts were slightly loose allowing his wings to move a little in flight. After he tightened the three 1/2" bolts in each wing (the Cozy uses the Long-EZ wing and wing attach system) the vibration went away. He checked several Long-EZs in his area and found a couple of them with the same problem. We had not had anything like this reported to us before and we checked the two Long-EZs we have here at RAF, both were solid.

The way to check for this problem is to have someone put their hands on the joint between the centersection spar and the wing to feel for excess movement while you lift at the wing tip. A small amount of movement, less than 1/16" at the wing root leading edge, is normal. If

excessive movement is detected, you must remove the wing bolt covers and torque the bolts. It is difficult to use a torque wrench in this area. We simply used two ratchet wrenches, each 6" long, and pulled about as hard as we could. It takes two people to do it right.

Since a person can pull with about 75lbs of force with one hand, we can calculate the torque - 75x5=375in/lbs or 31ft/lbs. Using this method, we have never had one of these bolts work loose. A 1/2-20 aircraft bolt can handle 600in/lbs (50ft/lbs) of torque. However, with the glass plies in between the aluminum hard points, we would recommend no more than 400in/lbs (33ft/lbs) of torque on these bolts.

CAUTION - Aeroquip 601 Hose Leaks.
We have yet another report of one of these rubber, reinforced-with-stainless-steel, outer, braid hoses that has suddenly sprung a massive leak. Again, it happened after the airplane had not been flown for a while. Our own experience with the Grizzly was that the airplane was not used for almost one year, then when we turned on the fuel valve and the boost pump, fuel ran out of the cowling just as though a line had been removed. A fuel line, an Aeroquip 601, was leaking at one of the fittings. This hose had never leaked before and no one had touched it between flights. We have now heard from at least four builders with this problem.

Here at RAF, we have gone over to Stratoflex Teflon hoses and we order them made up to the length we want. We have them pressure checked and have fire sleeves installed on each fuel line. These fuel lines are more expensive but we believe they are a much safer way to go. We have been getting our hoses from Aircraft Spruce and they are available from dash-3 to dash-8.

Check all your hoses aft of the firewall, both oil lines and fuel lines, frequently, especially if you have Aeroquip 601 hoses and even more frequently if you made these up yourself. A fuel leak aft of the firewall must be considered one of the most hazardous situations that can occur and must be taken care of before it happens while airborne. Replace any suspect fuel/oil lines. Have them pressure tested and have fire sleeves installed on each line.

ACCIDENTS/INCIDENTS
As always, the following reports are printed here solely in the hope that we can all learn from someone else's experience and/or mistakes.

A VariEze at an Airshow in France was seen to take off and fly low to the end of the short grass runway. He then pulled straight up, barely made it over the top of the half loop, then attempted a "Split S" recovery but was too low. The VariEze hit the ground just as the pilot leveled out, tearing out the main gear and sliding for over 70 yards on the belly. The bottom was ripped off from the nose to the rear seat. The pilot was seriously injured.

What can you say about such an accident? Don't let it happen to you. Low level aerobatics and buzz-jobs cause more accidents in EZs than all the rest of the accidents put together!

The following two incident reports were sent in by Long-EZ builder/flyer, Jimmie Hays.

"I had a totally unnecessary off-airport landing the other day. I pulled the airplane into an exceptionally nose high attitude while bleeding off speed from cruise to do some stall tests. As I pushed over to recover, the carburetor became unported and the engine quit. This wasn't altogether a surprise, but when the engine would not start right away after speed and "G" forces were returned, it was a definite surprise!

I went through all the emergency procedures (several times!), switched tanks, boost pump on, pumped the throttle, tried carb heat, talked to ATC, all to no avail! I was over distinctly unhealthy terrain but, fortunately, there were a couple of fields in gliding distance. I made the decision to lower the nose gear on short final, to absorb some of the landing shock and minimize nose-over possibilities. At about 25 feet, I noticed, for the first time, the tach was resting on zero! Too late to hit the starter, I went ahead with the landing. A very short landing roll in very sandy, loose soil. I am sure happy I decided to put down the nose gear. The only damage was some paint damage and the loss of one vortilon while loading it onto the wrecking truck which got stuck 4 times getting out of the field!

Obviously, checking the tach has now become VERY MUCH a part of my personal engine-out procedures. The prop had stopped in the horizontal position and may not have been noticed, even if I had looked back."

Canopy/Nose Gear Experience
"Less than 6 hours into my test flight period, I failed to lock the canopy before take-off. Everything went perfectly normally through rotation and until the mains came off the runway. Suddenly, the canopy slammed open against the safety catch. The noise level immediately went up from wind and engine noises. I, also immediately, thought of all the stories I'd read about control problems with the canopy open. I reached to grab the canopy with my left hand and my right hand subconsciously follow, driving the nose gear smartly back into the runway. I reacted almost as quickly, raising the nose again, but, alas, the nose wheel was no longer there. What a strange looking thing that nose gear strut is in the bare state when you look at it through the little plexiglass window.

Naturally, the nose wheel assembly had found the prop, so now I also had a lopsided prop to add to my problems. The nose wheel and fork assembly came through the whole affair quite nicely (and is still doing well with 200-plus hours). The only damage was the four bolts having failed as described in CP51. I retracted the nose gear strut and landed with minimal skin damage in the nose area. LESSONS LEARNED: 1) Fly the airplane! 2) the airplane would have flown quite nicely with the canopy open against the safety catch. 3) the airplane is distractingly noisy with the canopy partly open. 4) the canopy won't lift against the safety catch until just at take-off speed and attitude. 5) wooden props will keep going with quite a lot of damage. 6) FLY THE AIRPLANE, STUPID!"

REFUELING FIRE

We received this information third hand. We have not had any contact with the Long-EZ pilot. Apparently, after a flight in his Long-EZ, a Norwegian builder/pilot landed at an airport in Norway and requested fuel. As the attendant started to fill one of his tanks, a static spark jumped and ignited the fumes around the fuel cap area. Fortunately, a fire extinguisher was available and the fire was extinguished.

The above is all the information we have. We are endeavoring to find out more about this incident and we would appreciate any information anyone may have about this or any other similar incident.

This is the first time we have had a report of a fire while fueling an EZ. We have, of course, fueled many composite airplanes here at Mojave, literally hundreds of times, and we have never even seen a static spark. That is not to say it could not happen but of all the places it should happen, Mojave, with its extremely dry climate, would seem to be a likely candidate.

What can be done to prevent such an incident? If you built a ground strap into the tank connecting the fuel cap ring to the aircraft ground, and you grounded the aircraft during a refueling operation, this should not be able to occur. However, if your airplane was ever struck by lighting, the ground strap would conduct the charge. It would become red hot and melt which may cause an explosion/fire! Not a good alternative.

The most practical thing to do would be to always touch the fuel truck's ground cable to each fuel cap BEFORE you open these caps. This would discharge any static build-up on the aircraft skin/strake area. Another suggestion was made in EAA's Sport Aviation magazine and that is to make up a length of brass bathroom chain with a small clip on one end. Clip it to the fuel nozzle and drop the chain into your fuel BEFORE pumping fuel into the tank. The idea is to discharge any static that may build up due to the friction of the fuel running out of the nozzle into the tank. This would be in addition to the first suggestion.

We are not experts in this field at all. During fueling we, ourselves, have never taken any special precautions other than the normal grounding of the exhaust pipe (which may or may not do anything at all!) We have been fueling composite airplanes here at Mojave and, indeed, all over the United States for more than ten years without any evidence of a problem. We simply present the report of this incident as food for thought. If anyone has any suggestion as to what could be done to prevent such a thing, we would be pleased to hear from you.

PLANS CHANGES

There are no plans changes for this newsletter. Not for any of the RAF airplanes including VariEze, Long-EZ, Solitaire, or Defiant.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need help from you, the builder. If you come across an obvious error or omission in the RAF plans you are working from, please

send us the information so that we can print it here to help other builders.

For the same reasons, we request any information about building, flying or maintaining any of the RAF airplanes so that we can publish this information in the CP newsletter. This newsletter is for your benefit so if you want it to continue and be helpful and interesting to builders and flyers of RAF-types, send in your hints and suggestions!

FOR SALE
Cont. O-200A with 88 hrs, since major overhaul. Many other parts for a VariEze since we have decided to "part out" our EZ.
Contact: George B. Stillwagon, Jr.
546 Hathaway Rd.
Dayton, OH 45419

Cont. O-200A with log, 359 hrs, since major, 1861 hrs total time. $3600.00. Also many other parts for VariEze.
Contact: Daryl Lambert
11215 161 Court, NE
Redmond, WA 98052
206-882-2852

NACA FLUSH INLET FOR EZ'S
PLEASE NOTE: Tim Gehres has decided not to sell anymore plans for the flush inlet. He has gone out of business. There is no known source of the plans and RAF cannot assist you in trying to build a flush inlet.

BOB DAVENPORT'S NOSE GEAR SHIMMY DAMPER
Unfortunately, Bob have us the wrong area code for his phone number - the correct phone number is 305-567-1844. Bob's address is PO Box 650581, Vero Beach, FL 32965. We continue to run two of Bob's shimmy dampers and grow more and more convinced that this is the only way to go. Bob has complete kits and instructions available for

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$39.05. We strongly recommend this excellent shimmy damper to all VariEze and Long-EZ flyers.

GREAT AMERICAN PROPS
Great American is pleased to announce that they have completed a development program on a protective leading edge for their props. This is available on a new prop for $75.00 additional cost, or for $150.00 if you send your old prop in for a rebuild. This includes repairing, refinishing, and balancing with the new tough urethane leading edge. The urethane wraps around the leading edge and extends back almost an inch, giving a very large bond area, and offering exceptional protection from rain erosion.
Contact: Great American Props
1180 Pike Lane #5
Oceano, CA 93445
805-481-9054

RETROFITTABLE FUEL SIGHT GAUGES

Aircraft Component Technology (ACT) has developed a new fuel gauge for Rutan composite airplanes. A look over your shoulder rewards you with the truth about your fuel supply. It is a clear, shatter-resistant gauge which is backed by an opaque, white plastic base. Repeated blows with a hammer have resulted in deformation, never breakage. This is important because a broken gauge would mean uncontrollable fuel leakage into the cockpit. Like the Rutan composites, the gauges are intended for use with avgas. They are retrofittable from the cockpit side using flox and BID tape. A hand drill is the only tool needed.

Unlike the early model ACT EZ gauges, the new gauges are not illuminated nor are they equipped with a low-fuel warning system. Kits are $30.00 ($33.00 outside the U.S.) including shipping and piece-of-mind. Each kit contains two complete gauges and detailed installation instructions. Each gauge is 2" wide, 6 5/8" high and about 5/8" deep.

Inquiries may be directed to:
Aircraft Component Tech.
Attn: John Van Osterom
1501 Albright
Upland, CA 91786
Tel: 1-714-985-5887

WANTED
Cont. O-200 1/2 to 3/4 life, reasonable price.
Call: Simon Evans
0-689-349-75
Write: 27 Friar Road
Orpington Road
Kent, England

RAF QUARTERLY SPECIAL
We are closing out all shirts and have a few left at a special price. We'll sell these on a first come/first served basis. There are only small and extra large in the "Laughter Silvered Wings" T-shirts (blue) and extra large only in the RAF Polo shirts (white).
T-shirts - $ 5.00 ea.
Polo shirts - $10.00 ea.

SPECIAL NEW SPECIAL NEW SPECIAL NEW
Color Poster Featuring All The Rutan-designed Aircraft. Introduced this year at Oshkosh shows 18 of the Rutan aircraft in a beautiful formation flyby. The poster is a laser print of an original oil painting by aviation artist Jack Leynnwood. On the back is a complete chronological chart of all the Rutan designed airplanes. Poster is approximately 20" x 30" and will sell for $15.00 plus $3.00 postage and handling.

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

Featherlite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

FIRST FLIGHT PREPARATIONS
Tom Jewett of Littleton, CO sent us the following essay concerning preparation for your first flight. We enjoyed it and we agree with him 100%. We have printed it here so that all potential flyers can benefit from his perceptive point of view.

"March 22, 1986 7:35am Long-EZ, N35TM, takes off for its very first flight. After 2700 hours of work, it was time for some fun! That's right, fun! I believe that if all preparations are properly made, first flights of homebuilt aircraft should be fun. I would like to pass along my thoughts about the first flight of my Long-EZ, hoping that it will help others to have fun on their first flights.

A successful first flight depends upon four things being 100 percent ready. This simple checklist of four items includes: 1) The airplane, 2) The pilot, 3) The weather, 4) The circumstances. Great discipline is required to assure yourself that all four items on the checklist are 100 percent ready before attempting your first flight. Pressure to fly your new airplane will come from the most unlikely sources.

Obviously, the airplane must be ready, but what is less obvious is making sure that you have 100 percent confidence in your airplane. Prove to yourself that everything is in proper working order. If there is the slightest doubt about anything, fix it! The last thing you need on your first flight is doubt. I found that the best way to inspect your airplane is to have someone else double check your inspection. I was lucky enough to have other EZ builders and flyers who were willing to look over my work during construction and prior to the first flight. I was always amazed at the number of seemingly minor items to be corrected or adjusted that a different set of eyes would find. Even if you do not have other EZ builders or flyers in your area, enlist someone else to inspect your work. Do whatever it takes to develop 100 percent confidence in your airplane.

Pilot preparation for the first flight is very important because of all the "unknowns" that will be thrust upon the test pilot. Basic pilot proficiency must be very high so that the pilot can concentrate on how the airplane performs, not on basic pilot skills.

In my opinion, the best pilot proficiency preparation is recency of experience. During the four years of construction of my Long-EZ, I flew one airplane a total of 47 hours (less than one hour per month!) Needless to say, I was extremely rusty. To prepare myself, I flew the following aircraft: CE 150, CE 152, CE 172, American Yankee. All flights were made from the right seat to practice flying with my right hand and doing other chores with my left hand. I felt that flying the Yankee was the most beneficial because it is very similar to the Long-EZ, both in ground handling and flight characteristics. The major differences are: 1) The Yankee requires a higher power setting to maintain a comfortable decent rate during landing approach, 2) The climb rate of the Yankee is much lower than that of the Long-EZ. After I felt proficient in all these airplanes, I was lucky enough to get a

one hour flight in the back seat of a VariEze. The resulting critique of my pilot skills from an experienced EZ pilot was invaluable. In summary, I flew 13.8 hours in five different aircraft in the two months prior to flying my Long-EZ.

The other pilot preparation which I would highly recommend is to make a definite flight plan for your first flight. Use your owner's manual for procedures and target airspeeds, but do not forget that your airplane may behave differently from the airplane upon which the owner's manual is based. Discuss your flight plan with as many experienced pilots as you can. You will get good and bad suggestions, but overall, it will help. I wrote my plan out in the form of a checklist and practiced flying through it in familiar airplanes. You will be a test pilot on your first flight (and many flights thereafter) so practice being one!

The weather is a simple checklist item, but it should not be overlooked or neglected. Proper weather conditions are at least as important as any other item on the first flight check list. If, for any reason, you are uncomfortable about the weather, wait. Don't make yourself fight adverse weather conditions on your first flight. Make sure you have plenty of ceiling so you can fly at a safe altitude, and try to make your first flight on a cool day. All airplanes perform better at cooler temperatures.

Last, but not least, on the first flight checklist is the "catch-all" that I call circumstances. In includes many intangible things, the most important of which is the condition of the pilot. If you are tired from a full day of preparing yourself and your airplane, it is probably best to wait a day until you are fresh and your mind is clear.

Another circumstance to consider is traffic. Try to make your first flight at a time of low traffic. You will have your hands full with your new airplane, and heavy traffic will be an unnecessary distraction. Also, consider the number of spectators/assistants on hand to witness the big event. As you build your airplane everyone says, "Call me when you get ready to fly that thing." I, personally, think that having many spectators around provides more distractions than benefits. I chose to have only my wife and a fellow Long-EZ builder present at my first flight, and this worked quite well. The "ground crew" used a hand held radio and a copy of my flight plan so they could follow the progress of the flight and make notes as I transmitted them down. Having a support crew member who is familiar with your type of airplane and its systems is very helpful (especially in the event of any malfunction). However you decide to make your first flight, make sure that all the circumstances are correct and that your support crew is the one that you have chosen.

As you approach your first flight, you will be anxious to fly, and many opportunities to do so will present themselves, as they did for me. I mentally went through the checklist: 1) Airplane, 2) Pilot, 3) Weather, 4) Circumstances. At least twice I had three of the four items ready so I decided to wait. When I had four of four ready, I went flying, and I had fun! I was well prepared, the airplane

performed beautifully, the weather was great, and the circumstances were perfect. Be careful, and have fun!

VARIVIGGEN NEWS

Emerald J. Ullman, builder and pilot of VariViggen N22VV, wrote recently of a gear-up landing he had. It was night time at the Litchfield airport in Illinois when Emerald discovered that for some reason he was unable to lower the main gear. He tried the manual extension system and it, too, was jammed. He extended the nose gear, lined up on a hard surface runway, pulled the mixture, stopping the engine, and touched down on the small wheel/skids under the vertical stabilizers and the nose wheel. The aircraft rolled/slid out along the centerline of the runway and stopped within 600 feet. The small skids were ground down to within 1-1/2" of the bottom of the wing. No other damage was incurred to the aircraft. The skids have since been repaired and repainted and the aircraft was being reassembled as of June 28, 1987. "Main gear retract/extend system was built per Mike Melvill's modification, dated May 1978. The references to suspect parts that may have caused the left main gear to lock in the up position will apply to the drawings and parts of Melvill's modification. As mentioned above: The left main gear refused to extend from the up and locked position. Investigation at my shop revealed the following: Ref. Drawing #1: Set screw in left drive of Boston miter gear HLK-110Y was found to be loose. However the miter gear was retained within the gear box and on the MGB-4 shaft by the key/key-way. Note: It is possible that the shaft could have moved outboard-however probably no more that 1/8 inch. Ref. Drawing #3: Sec. A-A: AN 509 counter sunk bolt (left worm & worm gear drive assembly) through the center of CD1145 Boston worm gear and MG7 belcrank bearing had partially backed out of the anchor nut allowing some play in the worm gear CD1145 to the Boston HDVH worm. Note: It is possible that the worm gear/worm could have locked in a misaligned situation preventing both the electric drive and the manual crank down drive from functioning. (Speculation only). No other loose bolts, nuts, etc. were found throughout the main gear modification. My emergency manual crankdown system is very similar to Melvill's suggested plan as shown on Dwg. #6. The manual gear take off from the main gear box assembly was still solidly intact and not binding. After tightening the set screw on the miter gear, got into pilot's seat and performed the emergency gear let down procedure of releasing the electric motor from the main gear box assembly and releasing the uplocks on the main gear. (Note: the uplocks were not visible for inspection prior to letting the main gear down since wheel covers were in place). The main gear was then manually cranked down with no binding of the manual crank down handle as had previously been encountered during inflight attempt to crank the main gear down. Main gear box assembly was removed from aircraft and shafts under set screws of the three miter gears were recessed drilled. Gear box assembly was reassembled and set screws installed with "Locktite" and gear box reinstalled in aircraft. AN 509 bolt was tightened and secured in place with "Locktite". Wheel covers were removed to observe full movement of main gear and uplocks. Electric drive to gear box was used to retract and extend main gear. Uplocks functioned properly and no binding encountered, even with simulated negative and positive loads on the system while in operation. Manual crank down was performed and operated flawlessly in the static position of the aircraft. Other than the "speculation" of what could have happened as noted in the previous

investigation, I cannot add to the reason(s) for malfunction of the main gear retract/extend system.

Sincerely, Emerald J. Ullman
Builder/Pilot of N22VV"

EDITORS COMMENT
Emerald is to be congratulated on the excellent job he did of bringing his Viggen in at night with the main gear locked up. He kept cool, he made good, sound decisions, and he landed successfully and safely; a really impressive accomplishment. We have studied Emerald's report and, although there is a possibility that the loose set screw on the miter gear, or the loose AN 509 bolt through the center of the CD1145 main gear might have caused some kind of binding, we doubt it. The miter gear is retained in the gearbox and connected to the shaft with a key in a keyway. The worm gear and worm should work until the AN509 fell out, being loose should not have affected its ability to work. No, we believe the problem was probably associated with the uplock. Burt Rutan had three gear-up landings in the original prototype, N27VV, and they were all associated with the uplock for one reason or another. Since Emerald did not look at the uplock on the side that jammed, it is hard to know what happened, but we would strongly suggest that all Viggen flyers carefully inspect the uplocks and be absolutely certain that nothing can bind or jam this spring operated catch. If it won't unlock, no amount of effort will get the gear down, not electric motors nor hand cranks. Keep in mind that airloads in the air may push the gear up onto the uplock and make it bind to the point that the spring may be unable to pull the lock free to let the gear come down. Perhaps a little grit on the lock or bolt could jam it. It could be a number of things. In any event, it is mandatory that the pilot has the ability to manually pull the uplocks free with a strong cable. Check this in your Viggen and be absolutely certain you can manually unlock the uplocks before you fly again. Once you are certain the uplock unlocking system is fool proof, you should practice lowering the main gear using the emergency extension system. Do this first on saw horses on the ground - do it until you are satisfied it

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will work every time - then take off and climb to a safe altitude, pull the circuit breaker on the main gear motor, manually unlock the uplocks, and crank it all the way down. When you reset the circuit breaker, the green lights should be on and the motor should not run at all. If your emergency main gear extend system does not work perfectly, repair it and don't fly until it does. We do not recommend routine use of the nose gear emergency extension system while airborne since this really puts a heavy shock load on everything, including your instruments. However, you should be certain that it works freely and reliably on the ground before you go flying.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Johnny Murphy and his helpers preparing to static load Mike Cardinale's rejected Defiant Canard.

Left lift tab failure caused by extremely rigid steel fixture not allowing the lift tabs to flex apart when the canard bends. The bulkhead in the fuselage flexes under load.

Burt in the prototype Defiant taxiing out for the Unlimited race at Jackpot - He turned a 211.6 mph lap!

Peter Froidevaux's beautiful newly completed Long-EZ in Switzerland.

Left canard tip is on the ground after the left lift tab failed due to incorrect mounting method. Right lift tab is carrying all of the load on the right plus 2/3 of the load on the left!

5 "G" static load causes 18" of deflection at the canard tip with no failure of the canard.

Some of the 56 EZs and 2 Defiants in Casino Pete's parking lot at Jackpot, NV. It was quite a sight to see 116 winglets standing to attention.

Dave O'Neill's brand new Long-EZ, winner of the "Best Composite Construction" Award at the South African equivalent of the EAA convention held at Margate, RSA

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THE CANARD PUSHER NO 53 OCT 87

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 53. If you are building from 2nd Edition plans you must have newsletters 18 through 53. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 53. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 53. If you are building a Long-EZ you must have newsletters from 24 through 53. If you are building a Solitaire, you must have newsletters from 37 through 53. If you are building a Defiant, you must have newsletters 41 through 53.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please have your serial number ready. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF ACTIVITY/OSHKOSH '87
Since the last newsletter, we have been involved in the logistics of getting ourselves, and all of the necessary "stuff", to and from Oshkosh, Wisconsin for the 1987 EAA convention.

We would like to thank Larry Lombard and Michael Dilley for their tremendous help both in the RAF booth during the convention as well as in closing down and packing away the booth at the close of the convention.

The job of manning the booth is always tiring, but this year was eased considerably by having a great deal of help from Bernadette Shupe and

her merry gang of helpers from the IVHC. They certainly lightened the load and made it much more fun. Bernadette, of course, also organized the Hospitality Club dinner at Butch's Anchor Inn which was better than ever this year. One of the major highlights of the dinner this year was the extremely funny spoof on the Voyager entitled "The Record Breaking Flight of the Scounger". This was presented by Quickie builder/flyer and Long-EZ builder, Norm Howell. Norm has recently broken two world records in his Quickie.

The Voyager was on static display on the flightline at Oshkosh this year giving many of the Voyager supporters a last opportunity to view her close up before she is installed in the National Air and Space Museum. She was transported from Mojave to Oshkosh and then on to Washington, DC on an enormous truck normally used to transport oversize or overweight objects. The long journey took the Voyager and crew chief, Bruce Evans, through many towns on the way, giving yet another opportunity to many people to see her close up and talk with the ground crew, to say nothing of the photo opportunities. The Voyager will be hung in the museum on October 9, 1987, with an "official" opening of the Voyager display on December 14, 1987. (The first anniversary of her take-off to go around the world.)

The new color poster with 18 of Burt's aircraft designs was available for the first time at Oshkosh 1987 and proved to be very popular. This poster was advertised on the back of CP52 and will be on sale as a great Christmas gift next month.

As usual, there were far and away more RAF-type airplanes at the convention than any other type. "Mom" Rutan was hard pressed to get them all counted as they arrived and departed. In fact, this year for the first time, a couple of IVHC volunteers gave her a very much appreciated helping hand. She says that there were 50 VariEzes, 79 Long-EZs, 3 Defiants, 3 VariViggens, 1 Voyager and 7 "spin-off" designs. As usual, not all of these were registered. Irene counted 5 VariEzes and 8 Long-EZs not registered so, once again, the EAA "official" count will not be accurate. Next year Irene requests that you please register you airplane! It costs nothing to register!

DEFIANT NEWS

We were visited recently by Dr. George Best and his son, Michael, in their truly magnificent Defiant. Mike was very lucky to be offered the opportunity to fly this beautiful aircraft and he was very, very impressed! George had previously built an excellent example of a Long-EZ, his first homebuilt, so the Defiant was not an unknown to him. He says he really enjoys the contouring and finishing, if you can believe that! The contour perfection of George's Defiant must be seen to be appreciated. Quite the best Defiant we have seen! George had some help from one of the most innovative homebuilders there is, Tom McNeely, who laid out a really superb instrument panel, and also a very nice, clean and simple rudders-in-winglets installation. Tom also did the cowlings which are real works of art, flowing perfectly into the fuselage. The rear cowl has a flush NACA inlet and the outlets are on top, similar to the front cowl. The aft end is completely sealed. Really wild looking and, so far, works rather well. This Defiant is very smooth and quiet, particularly at a low cruise. As an example, Mike checked a couple of points at 10,500 feet, a normal cruise with both engines turning 2500 RPM, a total fuel burn of 11.5 GPH with an

indicated 140 KTS (160 MPH) gave a true airspeed of 168 KTS (193 MPH) for almost 17 MPG. A low, economy cruise with both engines turning 2100 RPM, a total fuel burn of 8 GPH, indicating 98 knots (113 MPH). George's Defiant holds 120 gallons of fuel, so at this power setting, he could fly over 2000 statute miles!

George originally had installed Hoffmann constant-speed, feathering, 3-blade propellers. He, like everyone else who had tried these props, had many problems trying to get them to hold RPM. These props have very small pistons inside the hubs. and therefore require very high oil pressure to hold maximum RPM and, of course, as soon as the oil comes up, the governor seals and main bearing seals allow enough leakage so that it is not possible to hold the pressure required. George had special high volume governors with a modified ratio installed and felt he just about had the problem whipped when disaster struck! The nose gear collapsed on take-off, the NG-2 weldment failed allowing the gear to retract. Of course, the front propeller was reduced to splinters and some minor front cowling work was required to get it back in the air. George ordered two fixed-pitch, wood props from Great American, and even though these were a first cut and not optimum for this Defiant, they work so well George will be sticking with the fixed-pitch, wood props and getting rid of the Hoffmanns.

He says that he was never really very satisfied with his Defiant with the heavy constant-speed props. It was heavy, did not maneuver well (keep in mind George is a Long-EZ driver). When he installed the lightweight wood props, he reduced his empty weight by 110 lbs. and, suddenly, the airplane flew like he thought it should, light, quick, and fun to fly. Mike flew it with the Great American fixed-pitch props and was impressed with the performance.

The failure of George Best's nose gear retraction link, NG-2, was what prompted the mailing of the mandatory change in NG-2 to a welded tube structure with no rod ends. The rod ends are not very strong if they see a side load. When the nose gear hit a curb-type bump or a chuck hole which caused the aft load to go directly along NG-2, the weak rod end bearings bent inward which allowed the main tube, NG-2B to bend. This let the rod ends bearings bend inward enough for one, or both, to fail, either causing the nose gear to be very difficult to retract and extend, or to collapse.

Charlie Gray had only one rod end fail on the way to Oshkosh. He replaced the NG-2 and made it to Oshkosh in the very slick Defiant he built for his friend, B. J. Jordan. He brought the failed NG-2 to Burt and Mike at the RAF booth where it was examined. Mike Cardinale of Merritt Island, Florida had the misfortune to run off the runway when his rudder/brake pedals pulled up out of the floor. The aft load on the retraction link, NG-2 caused exactly the same failure as Charlie Gray's and George Best's. The original Defiant, N78RA, built by Burt does not have these rod end bearings in it at all, rather, it is exactly like the mandatory change drawing sent out to all Defiant plans owners dated September 15, 1987. Do not neglect to make this fix. If you do not fix it, your NG-2 retract link will fail. When it does, the nose gear will collapse and your Defiant will end up sliding on its

nose. Depending on the speed and the type of surface, this could easily result in the lower cowling being ground away to the point of grinding on the carburetor bowl. If that should happen and fuel could escape from the ground away bowl, the result will almost certainly be a fire. This, obviously, could result in the total loss of your aircraft and maybe you. Ground your Defiant until you have completed this change.

Please note that on page 2 of the four page nose gear modification, sent to all Defiant plans owners, that the caution note pertaining to NG-4 stating the the bolt in NG-4 is the stop is not correct. Please ignore this caution note. When retracting or extending your Defiant nose gear, it is important that you grasp the gear handle and squeeze the NG-4 and hold it until the gear is either up or down, then release NG-4. Do not release NG-4 in the middle of the gear retract or extend cycle since this could possibly allow the NG-7 uplock link to flip over and jam the gear. Rodie Rodewald reported this problem to us. It happened to him twice in his Defiant. Fortunately, he was able to force the jammed gear down each time but he said it caused quite a little flutter in his heart for a minute or two!

A number of Defiant builders have reported problems in rigging their ailerons correctly. The plans change DPC #26 in CP 45, page 4, is incorrect and should be ignored completely. There is no differential in the Defiant aileron control system. To rig the ailerons, follow this procedure, in order: Rig the C-7 belcranks at exactly neutral as shown on page D-48. Lock them in this position with two small 'C' clamps. Both control sticks should now be firmly locked. Now, rig the C-27 welded crossover tube by adjusting the length of the cables from the stick assemblies to make the C-27 look exactly as it is shown on page D-26 (top left). Now, adjust the aileron pushrod tubes (rod end bearings) to the proper length to set both ailerons exactly at neutral. That is it! You will now have approximately + or - 19 degrees of aileron travel both up and down. (+ or - 2.3" at the aileron inboard trailing edge). Variations of up to + or - 0.3 at the trailing edge (i.e. 2" to 2.6") are okay.

AROUND THE WORLD IN TWO LONG-EZ'S

John Koch and Ed Roman completed their trip around the world arriving in Sacramento in June 1987. As reported in CP 50, John and Ed took off from Spokane, WA last year and flew their Long-EZs across the Atlantic ocean to Europe, Egypt, India and on to Australia. The weather was not favorable to continue and they were both low on funds, so they left their Long-EZs with Australian builder, Bill Sheedy in Bankstown, Australia and come home via airlines. Early this year, they returned to Bankstown and flew around Australia visiting Sydney, Adelaide, Port Headland, Broome, Alice Springs, and then to Port Morseby, Papua, New Guinea where they found themselves grounded by officials! Apparently it is illegal for single engine aircraft to cross the 400 miles of water that they did, to get there by the shortest route! After a day or so, this misunderstanding was cleared up and they took off across Papua, New Guinea - very tough country! - on to Biak, then to Menado in the Celebes. From there to Manila and on to Guam. They spent a little time on the island of Truk, southeast of Guam and really like the place.

From Truk to Majuro, and from Majuro, (2000-plus miles) over Johnston Island (emergency landing only!), on to Honolulu, Hawaii. Visited several islands in the Hawaiian chain, then departed from Maui, over Oakland to Sacramento. This was the longest leg and John arrived in Sacramento with 20 gallons while Ed had 15 gallons remaining. John's engine was a little stronger and consistently burned 1 qt. of oil every 25 hours average. Ed averaged 1 qt. every 8-10 hours. Both Long-EZs were equipped with Lycoming 0-235 engines and they generally cruised at 2500 RPM using 4.5 to 5.0 GPH, or for the long legs, at 2400 RPM using 3.7 to 4.0 GPH. No provision was made for inflight replenishment of oil. Loran-C (Apollo 612B) was the primary means of navigation. Only one serious glitch occurred when both 612B's suddenly decided to switch hemispheres! No warning light told of this problem and they very nearly got into trouble. John said it really shook his confidence in the Lorans. They contacted the manufacturer who, so far, has had no comment on this serious glitch with no warning light. Both aircraft were equipped with 37 gallon aux. tanks in the rear cockpits for a total of 88 gallons on board each EZ. Both aircraft performed flawlessly with only routine maintenance, oil and fuel plus one brake pad change in Cairns, Australia.

Would they do it again? You bet! Both had a great time. The only bad experience they had was Thailand, a place they vow never to visit again, and they don't recommend anyone else go there. They were charged $1560.00 for fuel and overnight parking!

Anyone wishing to try a trip similar to this would do well to contact John and/or Ed. RAF can supply their addresses and phone numbers to anyone who is seriously interested. They established several provisional world records during this incredible journey which, hopefully, will be ratified soon. When we asked John if he wasn't nervous crossing the Atlantic or Pacific oceans, single engine, he said, "No, not really, the Atlantic was actually a very easy, 'no sweat' flight, but the Pacific, now that is different, the Pacific is vast, and there is no sensation of gaining ground. You fly for hours with no change other than on the Loran. It took 17 hours to fly from Maui to Sacramento!"

What an unbelievable trip! The real mind boggling thing is that a trip like this can be undertaken successfully and, apparently rather easily, by two ordinary pilots in their own homebuilt airplanes - Long-EZs, impressive little airplanes.

STOLEN LONG-EZ
During the last week of June 1987, N83RT, a really beautiful Long-EZ IFR equipped with King avionics, was stolen from its tiedown on the ramp at Montgomery Field in San Diego, California.

The owner knew there was only 200 miles of fuel in the tanks, so he flew to every airport in a 200 mile radius and left a reward poster with two color photos of the plane and instrument panel giving all details such as equipment, serial numbers and identifying features. In addition, these posters were mailed to every tower-controlled airport and all flight service stations in California.

By great luck, and due entirely to the keen memory of a fellow San Diego VariEze driver, the above aircraft has been returned to its

owner. The thief had previously tried to steal a different Long-EZ from a hangar on the field. He failed for some reason, but did take the owner's manual which was later recovered from his home. When he flew away in 83RT, the tower operator, who knew the owner/pilot, exchanged pleasantries with the thief but did not realize it was not the owner. He flew only 30 miles to Ramona where is was hangared for two weeks while it was dismantled. Then it was removed to the thief's home where he seriously damaged the airplane, cutting out the wiring, instrument panel and sanding all identifying colors and numbers off the airframe.

By pure good luck, a VariEze owner/flyer landed at Ramona right behind the thief. He did not recognize the stolen Long-EZ as a local airplane and maybe that is why when, several weeks later, he returned to the airport and saw the reward notice, he called the owner. The San Diego police followed up and got the name and address of the thief and literally caught him about to repaint the aircraft.

What can we all learn from this incident? First of all, notify the local police and work closely with them. Give them all possible information (do you have all serial numbers, engine, avionics, etc. recorded?). Second, fly to all landing strips within a reasonable radius and talk to as many pilots as possible. Near the Mexican border, you might notify the Drug Enforcement Agency (DEA), also the FBI since stealing an airplane is a federal offense.

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Most importantly, we should all give serious thought to coming up with some method to prevent the plane from being flown. A plastic coated, heat treated chain wrapped around the prop and secured with a quality lock is good. Perhaps a fuel shut-off valve located, where only you know, in addition to the normal fuel valve. This could be shut off after you park it. Be very careful that this, or anything else you do to disable your aircraft, does not bite you in some way!! If you park it outside on an airport ramp for any length of time, notify the focal FBO, tower, mechanics, etc. that it will be there and ask them to keep an eye on it.

The owners of N83RT were extremely lucky. Imagine if you will, that this thief had managed to get the new panel installed and get the airplane repainted. He could have showed up at Montgomery Field with his "new" Long-EZ on a trailer, announced the rollout of his "new" Long-EZ, even had a little celebration to celebrate its "first flight" - may even been able to join the local San Diego EZ group, and probably no one would have been the wiser! Keep your EZ locked up if at all possible. The heartbreak of having it stolen must be experienced to be appreciated.

ACCIDENTS AND INCIDENTS

A southern California VariEze was taking off when it lost power at approximately 400 feet. The engine was leaving a trail of black smoke. The pilot was unable to make it back to the airport and crashed on rough ground about one-half mile from the airport. The airplane was severely damaged and the pilot sustained moderate back injuries.

The pilot believes that the plastic float in his Marvel-Schebler carburetor became "fuel logged" and sank causing the engine to run so rough it quit. He was aware that there have been some problems with these floats, but he said that the important thing was that he never thought it could happen to him! We appreciate such honesty and frankness and hope this will strike a firm note and prevent more pilots from suffering the same fate. See CP 41, page 6, for details on the float problems and things to watch for.

REFUELING FIRE IN A LONG-EZ
"To Ground Or Not To Ground?" By Alfred K. Tiefenthal
"I had intended to carry out an exact calibration of the fuel sight gauges of my Long-EZ. While in my hangar, and using a metal funnel and "Jerry" cans, I began pouring Avgas 100LL into the right tank. The metal funnel had three legs, but due to the cross wire in the Brock fuel tank opening, they were too short. I supported the funnel with pieces of wood and foam. With that arranged, the funnel did not touch the metal tank opening or cross wire but was a few millimeters away from it. I suppose it was at this gap that a spark jumped over and ignited the fuel.

This happened when I was pouring in the third can. The tank was about half full. Fortunately, there was no explosion, the fuel just started to burn. I must have bumped the funnel when the ignition happened because there was splashed, burning fuel all around the tank opening and dripping down the leading edge. The can I was pouring from was on fire and I, myself, got burned on my right hand, fortunately, not seriously.

I will never forget the nasty sight of my beautiful and beloved Long-EZ, after four years of hard work, burning all over the wing strake with the flames reaching almost to the roof! A few seconds later, I managed to extinguish the fire with a single blow from a powder-type fire extinguisher I found in the hangar, and it was all over.

There was very little damage, some discolored spots on the strakes and a few paint blisters along the leading edge. These were quickly repaired and, surprisingly, I actually flew the plane the next day!

There is no doubt in my mind that the source of the fire was a spark caused by static electricity. It was my fault, of course, that I did not ground the aircraft. Nor had I any grounding connection between can, funnel, and aircraft. I will never pour any amount of fuel into any aircraft without ground, and if I have to fill from "Jerry" cans, I will also make a ground connection between the can, funnel, and grounded aircraft.

It is illegal to refuel an aircraft in a hangar and without grounding and I was fined 500$ (Norway money!), but what is that?! I could have lost my airplane, or even my life, if the ignition had occurred earlier while there was a combustible mixture in the fuel tank- or it could have exploded.

My hope is that this story will prevent other builder/flyers from having a refueling fire."

The above letter was received from Alfred Tiefenthal who lives in Norway and it is the same incident as was described in CP 52. We made a couple of suggestions then and have received several comments concerning this incident.

A fueling fire is a very, very serious situation and anything that can be done to prevent it should be done. Also, be sure to have a suitable fire extinguisher at hand whenever you are doing anything with fuel.

Haley Haynes wrote to us concerning our suggestion of a brass chain and he is concerned that the chain should not be grounded to the fuel nozzle until after it has been dropped into the fuel. The connection to the fuel nozzle should be made as far away as possible and upwind from the fuel tank opening.

He says that at the present level of understanding, a static charge can and does build up on the surface of the fuel, probably due to molecular friction between two dissimilar materials, like cat hair and plastic.

The obvious solution would seem to be to install some form of uninsulated metal ground into the tanks during construction, and securely connect these to the aircraft ground and engine. Thus, the gas truck operator grounding your exhaust system would be grounding the fuel. Unfortunately, the problem is not that simple. This solution, in event of an airborne lightning strike, could result in the inside-the-tank ground strap becoming red hot and causing an explosion! Also, the fuel acts as a dielectric between the metal fuel lines and the static charge on the surface of the fuel. Therefore, a very large area ground is needed in the fuel tank. The aluminum mesh called "Explosafe" and advertised in Sport Aviation, if properly grounded to the engine during construction, may be a good way to go.

We would welcome suggestions and comments on this problem. The other side of the coin is, of course, the fact that many hundreds of EZ's have been fueled many thousands of times all over the world without any reported problem until we heard from Alfred Tiefenthal. Is the problem really as big as it seems? We wish we knew, but unfortunately, we are not experts in this field and we would truly welcome the view of any experts.

Our biggest concern, now, is that someone may actually cause a fire trying to avoid the problem by grounding his fuel incorrectly or in the wrong sequence. We are certainly going to have a nice big Halon fire extinguisher at hand for all fueling operations here at Mojave, but what to do on a cross-country?

CLUBS
(The one and only, first annual membership drive)
(PLEASE PASS THIS ALONG TO ANY EZ BUILDER/PILOT WHOM YOU FEEL WOULD HAVE AN INTEREST IN AND BENEFIT FROM CENTRAL STATES. THANKS FOR YOUR ASSISTANCE.)
Starting its 3rd year, Central States is an association of builders/pilots of Rutan designed and marketed aircraft.

Central States members have the opportunity to attend Spring and Fall Fly-ins and also receive quarterly newsletters containing valuable

information supplied by the membership pertaining to the construction, maintenance and operation of RAF-type aircraft.

Central States has in place a membership "hotline" if it ever becomes necessary to get critical information to all members in a hurry. Although it has never been utilized, the system is in place should ever a critical development require its usage.

The cost to join Central States is $12.00 annually and covers newsletters for the period of December, March, June and September. (Upcoming issues #9-#10-#11-#12.)

If you are interested in joining Central States, send a check for $12.00 payable to:

Central States
c/o Arnie Ash
Rural Route #5
Davenport, Iowa 52806

CP53, Page 3

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

VARIEZE PLANS CHANGES

MAN-GND
Next 10 hours - carefully inspect wing attach fitting for intergranular corrosion See page in this newsletter.

NO LONG-EZ PLANS CHANGES

NO SOLITAIRE PLANS CHANGES

DEFIANT PLANS CHANGES
DPC #26, CP45, page 4 is incorrect and should be deleted.

DPC #43, MAN-GRD
Nose gear retraction link, NG-2 with two rod end bearings in it, must be removed, discarded and replaced with a new part welded entirely out of 4130N tubing with no rod ends per the drawing mailed to all plans owners dated September 15, 1987. If you did not receive this mandatory change, send an SASE for a copy.

DPC #44, MEO
Defiant owners manual, page 27, lower paragraph: SHOULD BE CORRECTED AS SHOWN BELOW
Where: Empty moment and empty weight are determined by weighing. (See page 35).
Pilots moment = pilots weight times 95
Rear passengers moments = passengers weight times 135
Fuel moment = fuel weight times 149
Fuel weight = fuel gallons times 6.0
Baggage moment = baggage weight time 165
Total weight = empty weight + pilot + passenger(s) + baggage + fuel.

Two new world records set (provisionally, not yet ratified by NAA) by Long-EZ builder, Norm Howell in his beautiful, stock Quickie. See Sport Aviation, September '87, for an excellent article on N17UQ, "The Ugly Quickling". Norm flew 777 miles, using 11 gallons of gas, from Enid, Oklahoma to Dayton, Ohio on April 9, 1987. Then on August 1, 1987, he set a speed record for 15/25 KM of 112.5 MPH. Both records are in the C.1 A/O class for piston powered airplanes weighing less that 661 lbs. Congratulations, Norm, get that Long-EZ finished and come out and visit us, you hear?

SKETCH OF DEFIANT NG-2 WELDMENT OMITTED

FOR SALE
Please note that the policy at RAF for items to be included in this section is as follows: We will advertise engines, propellers, carburetors, engine parts, etc., for no charge as a service to our builders. We will not advertise complete airplanes, or parts of airplanes, nor will we advertise anything that is made by Ken Brock Mfg. i.e. engine mounts, prop extension, etc. We can not advertise against ourselves. RAF approved suppliers, such as Brock, Spruce, Wicks and FeatherLite, pay a small commission to RAF for the parts they manufacture and/or sell.

Cont. 0-200A 88 hours since major, plus many other VariEze related parts. We are parting-out our VariEze.
Contact: George B. Stillwageon, Jr.
546 Hathaway Road

Dayton, OH 45419

Source of Dot-5 silicone brake fluid in England. Ian Wilde found it and it is the correct material and costs $15.50 (Sterling) including postage from:
Automec, Ltd.
Stanbridge Road
Leighton Buzzard
Bedfordshire, LU7 8QP
England
Telephone: 0525-376608
or: 0525-375775

Long-EZ landing light, #4313, 12 volt, 250 watt, high intensity. Lists at $37.66. Only $20.00, brand new.

Facet electric fuel boost pump for 12v Long-EZ. Only $20.00, also new.

For above items, contact: Ray Ratzlaff
c/o Rutan Aircraft
Building 13 Airport
Mojave, CA 93501
Tuesdays or Fridays (805)824-2645

2 Woodward Governors
1 Pusher Hoffmann constant-speed, feathering prop.
Complete with blades and spinner.
1 Tractor Hoffmann constant-speed, feathering prop with spinner but no blades - 50 hours since new.
2 Marvel Schebler MA4-5 carburetors - yellow tagged-never used.
Contact: Dr. George Best
6630 E. Caballo Drive
Paradise Valley, AZ 85253
(602)991-0476

Mike and Sally are upgrading their Long-EZ, N26MS, and installing a King KX-155 NAV/COM. This means their Edoaire 720 channel RT-662 COM-only 2.6" x 3.2" x 11-1/2" and the Radair NAV with VOR head, also only 2.6" x 3.2" x 11-1/2" will be for sale. Mike intends having both units checked out by an avionics shop so they will be in excellent condition. Both have worked very well, indeed, and being so small, fit easily into an EZ instrument panel.
Edo COM - $350.00
Radair NAV with VOR head - $200.00
Contact: Mike or Sally
(805)824-2645
Tuesdays or Fridays

WANTED
One set of Paul Prout type fuel sight gauges with low level electronics. Please contact: Timothy Scott
72 Lochpark Rd
Traralgon, 3844

Victoria
Australia

SPECIAL XMAS SPECIAL XMAS SPECIAL XMAS
Color Poster Featuring All The Rutan-designed Aircraft
Introduced this year at Oshkosh shows 18 of the Rutan aircraft in a beautiful formation flyby. The poster is a laser print of an original oil painting by aviation artist Jack Leynnwood. On the back is a complete chronological chart of all the Rutan designed airplanes. Poster is approximately 20" x 30" and will sell for $15.00 plus $3.00 postage and handling.

XMAS SPECIAL PRICE - $12.00 (tax and shipping included)

Burt will autograph all Christmas orders! So please specify "Autographed" or "Unautographed". Sorry, no dedications. Time simply does not allow it.

Aircraft Spruce
P.O. Box 424
Fullerton, CA 92632
(714)870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
(618)654-7447

FeatherLite
P.O. Box 781
Boonville, CA 95415
(707)895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
(714)898-4366

SHOPPING
A truly excellent book has just been printed by the Light Plane Maintenance Library called Firewall Forward: The Top End. Price is $17.95.
Send check to: Light Plane Maintenance Library
1111 East Putnam Avenue
Riverside, CT 06878

Some of the subjects covered are: Top overhaul, when is it necessary? Post top overhaul breakin. Compression testing, dealing with low compression. Step-by-step removal of cylinders. Remedies for stuck piston rings. Cures for sticking valves. Checking mag timing, etc. A "must" for anyone building an airplane and doing his or her own engine maintenance.

Rocker/Valve Cover Gaskets - stop all leaks with 100% pure silicone "real" gaskets from The Real Gasket Corp.
P.O. Box 1366
Laurel, MS 39441-1366
(601)649-0702 or
1-800-635-REAL

Anyone who saw Doug's display at Oshkosh this year should be convinced for sure. They must be installed dry, no oil, no Permatex, and they will not leak. Mike and Sally have had a set on N26MS now for more than two years with no leaks. They are not cheap though, running about $30.00 a set for a Lycoming 0-235, 0-320, 0-360, etc., but are worth every penny since they are good for 2000 hours.

NACA Air Inlet Vent Doors - simply the lightest, simplest and most functional way to control the ventilation flow through your canopy vent. Developed by VariEze builder/flyer, Gene Zabler, who also sells a neat, lightweight nose wheel fender which will reduce prop damage from small stones and gravel thrown into the prop by the nose wheel.

Contact: Gene Zabler
48 Robin Hill Dr.
Racine, WI 53406
(414)886-5315

Teflon Hinge Pin Kit for ailerons and rudders on VariEzes, Long-EZs, Defiants, and Solitaires. Includes Teflon tubing and stainless steel hinge pin. Fits MS20001 series piano hinges.

Contact: Gary Hall
4784 NW 43rd St.
Lauderdale Lakes, Florida 33319
Home: (305)484-4949
Work: (305)974-6610

Please identify yourself as an EZ builder.

These Teflon hinge pin liners really do cut down on hinge wear, especially the ailerons which, due to their proximity to the engine, suffer much wear and tear from vibration. Send $21.00 and Gary will ship UPS. ($25.00 outside USA).

Dusty Rhodes of Vista Aviation on the Whiteman Airport near Burbank in southern California has recently done a number avionics packages for EZ's. Since Dusty built his own VariEze, he is quite familiar with our special requirements.

We were down there visiting Dusty and Brenda the other day when we saw a complete Long-EZ instrument panel on the bench. Dusty and Jeff, his avionics expert, were wiring the entire panel, including a full stack of radios and Loran - plus an HSI! Wow!

He showed us a really first-class "EZ" package consisting of the following:

King KX-155 NAV/COMM
King KI-208 VOR head
KING KT-76A Transponder
Apollo 612B Loran
Sigtronics SPA-400 Intercom

The "basic" package price, prewired and bench tested, is $4995.00. The trays are mounted together in a stack and all wiring is complete, including antenna wires and Loran antenna as well as mic. button and headphone jacks. All wires that you, the builder, must hook up (positive and ground) are correctly identified. Obviously, you will have to tell Dusty how long to make the leads to the mic. button and headphone jacks, as well as antenna wire lengths since each plane may be different.

If you want to substitute a KI-209 which includes a glide slope, add $400.00. If you want to substitute an Apollo 604 Loran for the 612B,

add $300.00. If you want to substitute a Northstar M1 Loran for the 612B, add $1300.00. If you would like to include an encoder, Dusty will wire in and bench check a Narco AR 850, blind altitude encoder for an additional $400.00.

When you are all done and have flown off your hours, you can fly in to Whiteman Airport, taxi up to Dusty's store, Vista Aviation, and he will do the required ramp check of your transponder for $35.00. If you have an encoder, he can do the full transponder/encoder and pitot/static system ramp check for $125.00. (These prices do not include any repairs or adjustments that may be necessary). The above checks are mandatory before you operate your transponder in VFR or IFR conditions. You must have this check done every 24 months and have a log book entry to prove it, to be legal. Be careful. FAA are really hot on checking this kind of thing lately.

Dusty really does know EZ's and is a very knowledgeable avionics man. He suggests not buying your COM/NAV equipment to soon before first flight since your warranty may run out before you fly! Also, do not have your avionics gear in the plane during the finishing process, i.e. sanding and painting, you could ruin your avionics. If you have strobe lights, be sure to shield the power cable and locate it as far as possible from the COMM and Loran antennas. Be certain to ground all radio trays together and to a common ground to eliminate noise.

Contact Dusty or Brenda at: Vista Aviation
Whiteman Airport
12653 Osborne St.
Pacoima, CA 91331
(818)896-6442

BUILDER HINTS

How to remove a stuck Phillips head screw.

Leo Dringoli, Long-EZ builder/flyer, sends in this helpful hint: The next time you are faced with a stubborn Phillips head screw where your screw driver begins to rotate out of the screw head - STOP!! Apply a small amount of OIL BASED valve grinding compound to the screwdriver bit and you will be astounded when the screw is effortlessly removed. "I now keep a small amount of this compound in my airplane tool kit", says Leo.

High cylinder head temperatures

Bob Hansen, 0-235 Long-EZ builder/flyer, has had high CHT's since day one. He says he has tried every suggestion in the CPs and many more to not much avail. Finally, in desperation, he cut two "reverse" scoops on top of the cowling with the leading edges pointing between the two cylinders on each side (see sketch). His first test flight after this operation was a pleasant surprize, 70 degrees to 85 degrees of temperature reduction at cruise. Bob's Long-EZ is equipped with a stock TASK cowling, has a NACA flush inlet with 45 square inches of inlet area, a 3" prop extension and an 0-235-L2C engine. Since Bob's success, fellow Sedona resident, Gordon Diehl, cut smaller openings in the top of his cowling (1" x 3") and he saw a 50 degree reduction at cruise. Of course, this amount of temperature drop is at cruise and is

only about 1/3 as good in a steep climb since it is so velocity dependant.

Test results:	CYL #1	#2	#3	#4
Previous best:	420 deg	450 deg	460 deg	425 deg
After cowl cutouts:	350 deg	380 deg	375 deg	355 deg

SKETCH OMITTED

How to install Long-EZ wings
If you are building a Long-EZ in a basement or a garage too small to mount the wings to the centersection with the centersection mounted into the fuselage, or if by mounting the centersection into your fuselage you can no longer get it out of your basement, or if you would just prefer not not mount the centersection in the fuselage but would like to complete the installation of the wings to the centersection, here is how it worked for Doug Shane (former RAF employee, now an engineer/test pilot for Scaled Composites).

Mike Melvill offered to help Doug after Oshkosh this year to try to get his Long-EZ completed by the end of the year. Doug had completed the fuselage, which was on the gear, and the canard and centersection. With occasional help from Mike's wife, Sally, and Doug's friend, Bob Williams, the two of them worked evenings from 5:30pm to 10:30pm and Saturdays - no Sundays! Sally and Bob helped with wing layups on a couple of Saturdays. To give you an idea of what a couple of determined fellows can do (should we say "lunatics"?) in exactly 6 weeks, working the above schedule, both wings, both winglets (upper and lower) were completed, then the ailerons were cut out, completed and hinged. The wing roots were completed, the wings were drilled and mounted onto the centersection spar, the winglets were mounted on the wings and the rudders cut out, completed and hinged. The centersection was mounted into the fuselage and the engine mount extrusions were installed. The canard was mounted and the entire flight control system was installed and hooked up. The brake master cylinders were mounted up front per Debbie Iwatate's instructions and connected to the rudder pedals. Not bad for six weeks of part time work!

During this exercise, the idea of mounting the wings to the centersection prior to installing it into the fuselage came up. Of course, this is the normal way it is done on a VariEze so they were not unfamiliar with the procedure.

Doug's garage is small, but surprisingly, with the centersection firmly bondo-ed to his work bench, carefully leveled laterally, as well as vertically (aft face plumb), the work bench plus centersection was placed diagonally and both wings could be mounted to the centersection. Some care was necessary in placing the workbench, but it just barely fit in his garage. The wings were strapped to the centersection using two nylon ratchet-type straps (see photos) on each wing. Using a level on the bondo boards on each wing, and some small wood wedges, the wings were jigged exactly into the correct position relative to the centersection and to each other. Generous blobs of bondo were used to fix the wings to the centersection spar. Doug then spent the next four hours drilling the 6 wing attach holes! That same evening, the bondo was cut and the aluminum flanged bushings were floxed in place and both wings were bolted to the centersection, properly shimmed so that the

bondo boards were level, and left to cure the flox to bushings bond with everything lined up.

The next day, the centersection was cut loose from the workbench and this complete unit, wing/centersection/wing, was taken outside for photos. Then it was installed onto the fuselage (out on the driveway) as a complete unit. Of course, the firewall had not been installed yet so the centersection was floxed into the fuselage and held exactly in the proper position, checking each levelling bondo board on the wings and measuring from each wing tip to the nose, by bondo-ing several pieces of lumber, strategically placed, from the fuselage to the centersection. All glass tapes were then installed to tie the centersection to the fuselage and also to support the engine mount extrusions.

This method worked extremely well, better in some ways than the plans call-out. The centersection was very securely mounted to a heavy workbench with bondo and pieces of 2 x 4 lumber, making it easier to mount the wings since it was not sitting on rubber tires and rocking around. It was at a much handier working height for setting the wing incidence and for drilling the mounting holes. Being able to measure from each wingtip to the nose guaranteed that the wing sweep was perfectly symmetrical, something very difficult to do per the plans installation.

Somehow, this method seemed to go quicker, too. In any event, we would recommend using this method to anyone who has remembered to leave the firewall bulkhead loose! Several photos of this installation will be printed at the end of this newsletter.

DEFIANT BRAKES
We have noticed a couple of Defiants with "Standard" 600 x 6 thin disc, single puck, brakes installed. These are not suitable for an airplane as heavy as a Defiant.

When Burt's prototype, N78RA, was rolled out in June, 1978 for its high speed taxi tests, it was fitted with regular 500 x 5 (thin disc) wheels and brakes! Needless to say, these brakes were completely ineffective becoming red hot and warping the discs, and fading so badly as to become useless. Next, we installed the thin disc, 600 x 6 single puck, wheels and brakes with essentially the same results - red hot discs, serious brake fade.

Cleveland recommended the part #199-133x, 600 x 6 with a 3/8" thick disc and a double puck brake caliper. These were installed and tested and the improvement was really dramatic. Burt's Defiant now has truly excellent brakes.

We highly recommend that you take full advantage of all the testing that RAF did to arrive at the homebuilt Defiant, and save yourselves the expense and hassle by obtaining a set of the Cleveland 199-133x, double puck, extra thick disc, 600 x 6 wheels and brakes from the beginning. Dr. George Best related to us how he started

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out with the thin disc, 600 x 6, wheels and brakes, found them to be very marginal, ended up buying the 199-133x wheels and brakes and is now very satisfied.

CAUTION: CORROSION IN VARIEZE WING ATTACH FITTINGS
A VariEze which had spent most of its life outdoors in the eastern US, but significantly, not on the coast, was found to have severe intergranular corrosion in the top plates of the wing attach fittings as well as in the two aluminum tubes between the top and bottom plates. Very little evidence of this was visible upon casual inspection. However, when the UND wrap on each end of the centersection spar was lifted, the corrosion was rampant and this EZ builder said he would not have flown this airplane knowing how bad the corrosion was.

All VariEze owners should make a very careful inspection of the aluminum wing attach fittings, especially under the glass that laps onto the aluminum plates, particularly if there is evidence that the glass has peeled or delaminated from the wing attach plates, both on the wings and the centersection spar.

For new construction, all aluminum parts, including wing attach fitting, should be cleaned in Alumiprep33 or metal prep #79 and then soaked in Alodine 1201 which is a visible (golden brown) moisture barrier, greatly increasing resistance to corrosion. This also acts as an excellent surface to bond epoxy or paint.

Do not anodize wing attach fittings since this finish, if not done exactly right, can cause embrittlement in the highly stressed wing attach parts.

Alodine is a common aluminum preparation and can be obtained from RAF-approved suppliers such as Aircraft Spruce or Wicks Aircraft.

CAUTION: BINDING BRAKES
Dave O'Neill, Long-EZ builder from Johannesburg, South Africa, writes of his first flight. Empty weight was 849 lbs. with starter and alternator and 500 x 5 wheels. The only problem Dave had was one that could effect all of us and this is binding brakes. Even a fairly light binding of the brakes can increase rotation speed significantly. Dave had to accelerate to more than 15 kts. above normal rotation speed in order to get the nose wheel off. This is potentially quite hazardous since you are taxiing at above flying speed and things could get out of hand quite rapidly in the event of some small problem. Check your brakes before you go out to do your high speed taxi runs and be sure that the brake discs turn freely between the brake pads when the brakes are not applied. Thank you for this important point, Dave, and congratulations on your first flight.

CAUTION: AIRSPEED INDICATOR INACCURACIES COULD CAUSE PROBLEMS ON A FIRST FLIGHT.
Fred Mahan, Long-EZ builder/flyer reports that on his first flight he was uncomfortable on final, felt too slow, decided to check his airspeed indicator. Using a water manometer, Fred discovered that his airspeed indicator read 200 kts. when the manometer said 200 MPH. This continued all the way down to 40 kts, so his airspeed had been mis-graduated by somebody. This meant that when he was indicating 75 kts., he was, in reality, only doing 65 kts.! This could have been a

"gotcha"! Of course, it was great at the high end. Fred thought he was going really fast! Check your airspeed indicator before first flight. See the neat water manometer suggestion in this CP.

USERS OF ROTORWAY RW-100 ENGINES - John S. Derr is forming an association for those EZ flyers who are using the above engine. Please send your name, address, daytime and evening phone numbers, serial number of engine, type of plane and status of project, any photos or written material you would like to share. If John gets enough response, he will underwrite the first issue of a newsletter. John is a professional scientist and is used to gathering data and presenting it in a reasoned way.

If you have a Rotorway engine and are interested in such a newsletter, contact: John S. Derr
706 Partridge Circle
Golden, CO 80403

HOW TO TEST YOUR AIRSPEED INDICATOR by Verne Vawter
This neat water manometer article is taken from the Long-EZ Squadron 1 newsletter.

One instrument in my airplane that has been a source of constant irritation is the airspeed indicator. For some reason mine always reads too low and my friends' airplanes, at least during hangar flying sessions, say they are always faster than mine.

On the verge of an inferiority complex. I decided to do some investigation which revealed that the airspeed indicators are based on a well known physical law and that it is feasible for owners to check and calibrate their own aircraft's speedometer.

Before I relate the principles of airspeed theory, based on Bernoulli's Law, let's get right into how simple it is to make an instrument called a manometer, which is easily put together of a little of this and that found at most hardware stores.

EQUIPMENT REQUIREMENTS:
1. Approximately 10 feet of clear plastic tubing preferably 1/8 inch to 1/3 inch inside diameter (it should cost between $1.00 and $1.25).
2. A board 30 inches in length suitable for mounting the plastic tubing in a "U" shape.
3. Some type of "T" fitting. This can be made by soldering small pieces of copper tubing together.
4. A yardstick.
5. A few ounces of water with a little bit of food coloring to aid visibility and a small quantity of detergent as a wetting agent.

TESTING PROCEDURES:
1. Examine the pitot tube carefully and if there is a small drain hole, cover it with tape.
2. Stretch the one end of the plastic tubing over the nose of the pitot tube (see Fig. 1).
3. Blow the manometer until the water level between the two sides of the tube has approximately 20 inches difference in heights. Pinch off the air supply tube and check for leaks. If the manometer and the static system are free of leaks the water level will remain constant.
4. With one person in the cockpit viewing airspeed indicator, bleed off the air by releasing the pinch referring to the chart (see

Fig. 2) for proper water level differences. Start with a water level that is appropriate for the speed of your aircraft. For example, if your plane is capable of 180 mph, there should be 16.16" difference between the levels of water in the "U" shaped tube. If your airspeed indicator is reading 183 at the 16.16 inch differential level, you know it's 3 mph fast. Repeat the procedure at 160 mph, 140 mph, 120 mph and so on. Most airspeed indicators are usually two to three mph off somewhat in their range. Naturally if there is a leak in your airspeed system this is indicated by an inability to hold the water level. It is sometimes difficult to bleed the correct amount of air to reach the exact inch difference that you want. Often several attempts are required. The yardstick is moved up and down so as to measure the different levels that the water will reach.

DRAWINGS OMITTED

Bernoulli's Law: The controlling physical law of a manometer

$$hw = \frac{Pair}{Pw} \cdot \frac{V\text{-squared}}{2g}$$

hw = height of water inches
Pair = density air
Pw = density water
V = velocity air miles per hour
g = gravity

V (mph)	Hw (differential height of water in inches)
60	1.77
80	3.16
100	4.95
120	7.14
140	9.73
160	12.7
180	16.16
200	20.0
250	31.6

LETTERS

"In the spring of 1980 my Long-EZ arrived. Boxes, boxes and more boxes. It was mind-boggling and overwhelming to contemplate. But the plans were very specific and the section-by-section, step-by-step format was easy to follow. The one thing that took the most time was the financing of the project. And so, 7 years later, start to finish, I towed 29TM, with a police escort, to the airport, one mile down the road from my front door.

Then the fun began. Final checks, taxi testing and runway flights, (it flies level and stable with neutral trim) FAA final inspection, which it passed with flying colors, and I was ready for the big one - FIRST FLIGHT.

July 19, 1987 the sun went down on a clear, calm sky. I went to bed early planning on an early morning start. July 20, at 7:30 in the morning I stepped out of the door and it was so dark the street lights were on (black clouds). I turned on the radio and the first words I heard were "tornado warning". Four tornados were sighted within five miles of the Grand Rapids airport. But as the day progressed the weather cleared. The plane was ready and I was ready.

After a final check I taxied 29TM out to runway #34. Winds were 5 to 10 from 280 degrees. I eased the throttle wide open. My heart rate went up with the

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tach. Rotated at 65 kts. and at 79 kts., with a little more back pressure I was off. I settled into a 90 kt. climb and the hand on the altimeter looked like the second hand on a clock. At about 600 feet, a big bumble bee circled my head. Just what I needed! I was already nervous enough with an unfamiliar airplane on its first flight and now this. I climbed out to about a thousand feet, trimmed for hands off flight, took off my head set and then my cap. As the bee landed on my sleeve, with the aid of the aforesaid cap, I grabbed him and crushed him. I opened the cap and he dropped between my legs to the floor. With a sigh of relief, I went back to the business at hand.

My first landing was not all that good. I came across the numbers at about 80 kts., set it down and got on the brakes hard. My second and all subsequent landings have been much better. When I climbed out of the plane the bee was still crawling around on the floor between my legs.

Later that day, after a cup of coffee to settle down a bit, I took her up again and spent an hour playing.

29TM flies like a dream, solid and responsive and is a pure joy to fly. It lives up to all its advance billing.

Tom Montague"

44JD flies 82CD
"While having breakfast solo at the Sedona Airport, a man at the next table saw a Long-EZ take off and opened a conversation with me by saying, "That's the kind of plane you should fly". I'll never have a better opening. I said, "I do! And that's half my plane! And my husband's flying it!" I felt like bragging.

I worked very hard to get to this place and I'm basking in the glory. It was always my intention, and dream, to fly that beautifully sleek airplane half the restaurant watched take off that muggy Saturday morning in August: ever since I met Gordon Diehl a little over two years ago in San Diego.

I spent two years trudging toward my private. Getting the ticket was no breeze being no Amelia reincarnate. Four trips to the FAA examiner and an infamous old bird she is! Finally thoroughly checked out, I took a 2-1/2 week, 30 hours, solo cross country over to California, up to Ashland, Oregon and back in my Cessna 150 staying with such wonderful people as Bernadette and Don Shupe and Bonnie and Bruce Tifft.

A week later I taxied our Long for a couple of hours until with great trepidation I took off solo... and I took off... and then I finally took off... realizing I didn't have the canard high enough.

"Whoopee!!! I'm really up here! Now can I get back down?" The half hour was exhilarating and the visibility spectacular. "Boy this sure beats the back seat." I was astonished that I could have so recently enjoyed 30 hours at 80 kts. in the now obsolete Cessna. Yes, I was spoiled already.

My first attempt to land was too high. I can just hear Gordon saying, "I told you so." I actually hear him on the radio, "Is the nose gear down?" I went around and then got a good glide slope on the VASI at about a 2 mile final, minor adjustments coming down, I flared and held it off until 82CD touched down like a dream. "Hey you guys, piece of cake. Here I've had all you Eze pilots on a pedestal for two years and this is really EZE."

For the next two days, I nagged at myself that it was beginner's luck. I braved it again with a lovely smooth take off and flew for an hour, climbing to 12,500, soaring down to pattern altitude, swooping 40 degree turns around the gorgeous red rocks while listening to classical music. I have never been so relaxed flying. I completed my finest flying hour with another effortless landing.
So, go for it, Gals! Don't let the guys have all the fun!

Jeri Jene Diehl"

Congratulations, Jeri, on joining the ranks of EZE pilots. (Editor)

"Dear Burt,
I was disappointed that, upon my return to San Diego, I was unable to stop at Mojave to inform you of our Atlantic adventure. Gene Scott, of Plane Doc at Gillespie Field, is a very good friend of mine and had convinced me to join a partnership with Ed Esteb and Bill Hargis in a Long-EZ which we completed in March of this year after four and a half years of building. We had a great deal of help from Robby Grove and a number of the people at the EZ club in San Diego and it's not possible to list all of the people who participated in the fabrication and modification of this fine machine. It has a new canard, the "almost-constant-speed" prop, a Lycoming 0-235 L2C rebuilt with F pistons, and the Avionics package is IFR with Loran and HF. After testing and a few design changes, I flew it to Shannon Airport (Ireland) and back via Greenland and Iceland this month. Except for the collapse of a nose gear at Narsarsuaq, Greenland, during a 29-knot shifting crosswind landing with almost full fuel tanks, a broken field wire, also in Greenland, and the replacement of an alternator at Omaha on the way back, the plane performed flawlessly. Obviously, none of these were design problems. Gene accompanied me in Gerry Hansen's Cessna 182RG from San Diego to Narsarsuaq, Greenland, where he had to leave it and proceed commercially on Iceland Air when his fuel requirements rendered continuation unwise. He picked it up on the way back. He was more than a little upset that he didn't take his own Long-EZ but he and Gerry were not keen for the possible loss of their own fine aircraft.

I did want to let you know that the plane was flown in heavy rain and, unavoidably, some icing. In both conditions, and even with a thin film of ice or ice droplets on both the leading and trailing edges of the canard and main wing, there was no detectable loss of control or tendency towards stall or loss of lift as we had noted with the earlier canard.

I did experience the need for slightly more excursion of the stick to accomplish gentle turns but this was almost negligible. The lowest temperatures I could measure at 12,000 feet over the Greenland Ice Cap were in the range of minus 25 degrees Celsius. The engine wasn't overjoyed and I needed full carb heat to keep it running smoothly and CHT above 300 degrees. I haven't yet been able to figure that out unless there was some moisture in the fuel. There was no visible moisture over the cap. I had fabricated a cup ice protector over the elevator counterweights on the underside of the canard and I'm happy I did. The Loran worked fine wherever it was available. I installed a centerline antenna behind the canopy between the fuel vents when our built-in winglet Loran antenna proved unsatisfactory. I installed a window screen under the seats from the avionics panel to the firewall with a common ground for groundplane. We had previously imbedded copper strips in the wings for an ADF groundplane and I believe this enhanced the Loran reception as well.

The longest overwater was eight hours in fairly strong headwinds from Rekjavik to Shannon in Ireland. Stornoway was "closed" and I decided to dogleg it directly. I landed with over two hours of fuel still in the tanks.

I'll take the chance of incurring your wrath to tell you that, with all the Emergency Gear, including a raft and minimum Transport Canada requirements, 2 ELT's and a hand-held Terra 720, an HF and full-panel VHF, VOR, Transponder, Loran, DME and a hand-held Marine DDF, exposure suit, minimum clothing baggage, tools and full tanks on every takeoff, with an empty weight of 965 lbs., I was probably a "little over gross!" The only time I felt it, though, was at Grand Canyon, on the way back, at 6,600 feet and 87 degrees F on the ground. 97 hours, 16,000 miles, an average of 130 knots and 10 plus 30 endurance, occasional IMC, and an unending supply of open mouths and cheering were present at each stop for the unbelievable genius of a guy named Burt Rutan. Everybody I ran into knew your name and your achievements. I never once had any doubts about the design capabilities of this plane and I'm looking forward to your next breakthrough. Thanks for letting me break out of my own closed world into an unforgettable adventure.
With highest personal regard, very sincerely yours,

Sidney Tolchin, M.D.
4421 Mayapan Drive
La Mesa, CA 92041
(619)579-0364"

CP53, Page 8

"Dear Mike,
Enclosed is photo of N23TR which flew 1st flight July 11, '87.

I'm using two I0-360B1A engines with Hartzel C/S prop (70") in front and Great American prop (70 x 78) in rear. Weight was 1887 lbs. with large amount of extras - S-Tec autopilot, radar altimeter, full IFR panel, etc. I put 75 lbs. ballast in rear baggage compartment to bring CG into center of box for 1st flight. With no ballast, CG was in flight box at 122.1. Initial taxi tests to 65 MPH revealed no ground

handling (nose gear or brake) problems. (I have Don Forman's shimmy damper installed.)

The first flight was basically "out of the box" with no adjustments needed and only revealed a slight left rolling tendency with nose gear extended. This was easily compensated by the roll trim on the elevators. After retraction on 4th flight this left roll tendency disappeared. So there were absolutely no surprises during first few hours testing. I had to pull landing (2 of Dusty Rhodes 250 watt bulbs) light out of front intake to get good cooling. Rear oil temperature running around 210 degrees and front, 170 degrees. C/H temperature about 350 range, front and 390, rear.

I should fly restrictions off by early Sept. and, it goes to paint shop mid-October. I have about 2,900 hours in project so far and am very pleased at this point.

I don't have any meaningful performance figures yet, but will send them out to you as soon as available.

Sincerely,
Ted Rogers"

The following three letters are concerning a lightning strike on a Long-EZ flown by Dick Kreidel. We certainly thank Dick for taking the time to write the account which Burt sent to Andy Plummer for his comments. Mr. Plummer is one of this countries leading authorities on lightning strikes and his letter is, also, reproduced here for all of us to read and inwardly digest. Pay attention, guys, our EZs are not indestructible, although many of us fly them as though they were.

"I deliberated for a long time whether to publish this account of poor judgement and foolish mistakes. When I read it now, on the ground, three months later, the faulty reasoning is easy to see. But I assure you, that the decisions and events on May 23rd were made to the best of my ability and skills. My hope is that someone will benefit from my errors. It is a fine line between being around to tell a story and not being around.

This account was originally sent to RAF for their comments. Burt passed it on to Andy Plummer of Lightning Technologies who is reputed to be the foremost lightning expert. Mr.Plummer's comments follows my tale.....

I departed New Orleans Lakefront Airport IFR to El Paso at approximately 9:30 a.m. local on Sunday, May 23rd. I had received a thorough weather briefing from Flight Service only 20 minutes earlier and they indicated that westbound I shouldn't have much problems; rain showers and multiple cloud layers with tops at 14,000' to 16,000' MSL with a thin cirrus layer at 25,000'. Live Radar and FSS painted a line of thunderstorms about 20 miles south but it probably wouldn't arrive at Lakefront for at least an hour. I was cleared to 16,000' and had gone through multiple layers of cloud and picked up some light clear ice after a climb through 12,000'. I requested from ATC to hold at 14,000' for a while since I was between layers and the next ceiling didn't look as thin as advertised. The OAT at 14,000' was +1 degree C. I flew through some heavy rain and more ice accumulated on the plane,

especially the canard, elevators and vortilons. The wing did not appear to have much ice on it and I could not see any on the winglets or the intersection between the wing and winglets. Indicated airspeed at 2400 RPM was 122 KIAS. The ice on the canard covered about 20-25 percent of the chord with some "streamers" that went back to perhaps to 50 percent chord line. Ice formed below the trailing edge of the elevator about 1/8" thick with a uniform spanwise distribution. The ice on the canard was definitely clear ice but what was below the trailing edge of the elevator looked more like mixed or rime ice. The elevator position was about 5/16"-3/8" T.E. down. The airplane was very controllable with good elevator responsiveness. I could have easily climbed if I had wanted to so I was not overly concerned.

ATC was giving me radar vectors to stay clear of any CB's but indicated that contrary to my preflight weather briefing, the "weather west of New Orleans is really wicked with the big boys having trouble going through!" Center advised that the only way they felt would be O.K. would be to deviate approximately 60 nm due North - obviously I followed their recommendation. After a few minutes I was again in cloud and it became increasingly difficult to hear radio transmissions - static was all that came through the headset.

I started receiving small electrical shocks from the roll trim lever through my jeans and shocks from the microphone to my lips. I became aware of the transparent blue glow that was on the nose and canard. I say blue but somehow it seemed blue with a pink tinge. The color was similar to the bright blue from a gas welders flame. This halo was about one chord width above the canard and seemed to "move" - it is very difficult to describe in words. I was now getting shocked through the speed brake handle and from the rudder pedals to my ankles (my feet were in the relaxed position forward of the pedals). The B&D tachometer was bouncing erratically from 500 RPM to full scale and both Nav CDI displays were swinging from stop to stop. The electric engine instruments were also useless - I didn't notice what the wet compass was doing. Here I was: IFR conditions, icing, no communication or navigation, thunderstorms and weird light. So far the ride was smooth with no rain or hail in the cloud - the cloud was not a dark, heavy one. The blue (pink) glow increased in intensity and its movement was more rapid. I am not sure but I believe that the blue glow was now inside the cockpit between my face and the instrument panel, but I could still easily read the gages; it was right out of the Twilight Zone.

I saw a bright flash way ahead of me that seemed to go from left to right that really lit up the cloud I was in; I assumed that it was cloud to cloud lightning and that I was definitely in deep grease! The com was still all static and calls to center were unanswered (or perhaps unheard). I was so scared that I was sure that this would be the way it would all end and Kay (my wife) would really be pissed! I smelled a thick sweet odor, got one good shock from the microphone and then there was a tremendous flash of light and an incredibly loud "crack" - I felt it in my bones and chest as opposed to hearing it.

I had been looking out at the right wing trying to figure out why the blue halo was not on the wings, only the canard, when the flash occurred. I was temporarily blinded so I removed my hand from the stick hoping I wouldn't enter a spiral dive. When I could see again

(10-15 seconds), to my amazement 1) I was still alive and 2) the plane was still level at 14,000' on my last assigned heading of 060 degrees. The blue halo was gone and I heard a transmission on the com for a Delta jet. I called center to see if my radio was blown and they immediately answered my call! Apparently they had been trying to reach me to give me a new vector and immediately turned me to 330 degrees. The airplane was again between layers and the visibility was good, I could even see patches below. Everything appeared to be working O.K. but the plane still had a lot of ice on it and I didn't think I was in any mental state to fly an approach. The airspeed now read less the 50 knots so I knew that the pitot tube had iced over. The weather seemed to be improving rapidly with a broken layer above and below with some beautiful blue sky far in the distance. Since the plane would easily climb with full power and the remaining aft stick I saw no reason to descend and kill myself making a lousy IFR approach after all of this! I then saw several dark patches on the wing and winglet leading edges that upon later inspection were areas where only the glass skin remained. In about 20 minutes all of the ice melted and the elevator position returned to 1/16" T.E. up and the airspeed increased to 140 KIAS at the same power setting of 2400 RPM. The flight continued normally in IFR and I landed at El Paso International four hours later.

So what is there to learn from this unwanted experience? Probably several things. First, that the invincibility I felt in B888EZ contributed to my cavalier attitude in flying in bad weather - this certainly was not the "California IFR" that I was used to. After nearly 1100 hours of flying in a plastic cocoon, I had developed a false sense of immortality - after all, the EZ had gotten me through some tough situations before. Also, I learned to never, ever trust ATC and/or FSS - the pilot must make his own decisions and evaluations on when to commence or terminate a flight.

Another significant revelation is that although the Long-EZ is a great plane and can leap tall buildings with a single bound, it is not suited for hard IFR flights with embedded thunderstorms. I consider myself extremely lucky to have survived this flight - my skill and judgment (or more correctly - lack of both) hopefully will serve me better in the future.
Dick Kreidel"

SKETCHES OMITTED

FIG. I Ice distribution on canard and elevators.
FIG. II Ice on vortilons.

SCALED COMPOSITES INC.

0554/87
3 June 1987

Andy Plummer
Lightning Technologies

10 Downing Parkway
Pittsfield, MA 01201

Dear Andy,

As you may recall when you visited about 10 years ago, we, as well as hundreds of other homebuilders have been flying without lightning protection and with apprehension as to what would occur in a lightning strike. The enclosed account is from Dick Kreidel of Yorba Linda, California who was flying his Long-EZ when it was struck by lightning.

I would appreciate any comments you could pass on to us or any recommendations of analyses which should be done. I am wondering if any data is available on laboratory strikes on fiberglass skins with foam cores. If so, I would like to look at that information to get some idea of the intensity of Mr. Kreidel's strike.

Best regards,

Burt Rutan

ELR/kl

cc: Mike Melvill
     Dick Kreidel
     Jim Terry

SCALED COMPOSITES, ADVANCE LINK TO EFFICIENT DEVELOPMENT
HANGAR 78, MOJAVE AIRPORT
MOJAVE, CA 93501
(805)824-4541

LIGHTNING TECHNOLOGIES, INC.,
10 Downing Parkway,
Pittsfield, Massachusetts 01201
(413)499-2135

22 July 1987

Subject: Long-EZ Lightning Strike

Reference: Your Letter of 3 June 1987, Same Subject, with
            Dick Kriedel's Letter Attached

Burt Rutan
Scaled Composites, Inc.
Hangar 78,
Mojave Airport
Mojave, CA 93501

Dear Burt:

I have studied the interesting account of a lightning strike to a Long-EZ by Pilot Dick Kreidel, accompanying your letter of 3 June, and have the following comments:

1. After beginning the deviation North, the aircraft entered an electrically charged region, as indicated by the static in the communications system, "small electrical shocks" and "blue glow" (corona) on aircraft extremities. The electric shocks were due to electric field penetration of the non-conductive fiberglass airframe. The erratic behavior of the instruments was also due to electric field interaction with the interconnecting wiring. It is very likely the the corona was indeed occurring inside the cockpit as Mr. Kreidel suspected.

2. The synoptic weather conditions reported by the pilot are very characteristic of those reported by other operators when lightning strikes have occurred (~14,000 ft; icing, precipitation, within a cloud, OAT +/- 5 degrees of freezing). Apparently the aircraft was near embedded thunderstorm cells, though lightning strikes have been known to originate in "layered" clouds as well as CB clouds.

3. The "flash of light" and "loud crack" indicate a lightning strike, although evidently one of mild intensity as indicated by the comparatively minor effects on the aircraft. At 14,000 ft. it is likely that the aircraft encountered a branch of a flash, rather than the main channel of a cloud-to-earth flash; as illustrated in the following sketch. **SKETCH OMITTED**

4. The electric currents in a branch (of which there are a lot in a typical flash structure) are usually much less than that in the main channel. Even so, the flash and noise can be frightening if experienced close at hand.

5. Apparently the lightning current entered one wing tip (take your pick) and exited from the other, being conducted by internal metal conductors between. The amount of damage to the fiberglass and foam structures indicates a very mild strike - perhaps 5 kiloamperes or less (Part 23 rules require an airframe to tolerate 200 kiloamperes).

Comments

1. Pilot Kreidel was lucky! A more severe strike may well have caused major structural damage and lethal voltage difference among metal objects in the cockpit (column, pedals, headphones, etc.) as well as severe damage to internal electrical conductors such as control cables, hinges, bearings, rods, electrical wiring, etc. These voltages and currents can be far in excess of fatal levels. Electric fields and lightning strikes themselves will directly penetrate unprotected fiberglass structures, attracted by metal objects within - not matter how small.

2. This is another example of the fact that ATC cannot be relied upon to vector an aircraft safely around- and clear of - hazardous thunderstorms. Controllers are not provided with sufficient (and timely) information for this purpose. Even though avoiding areas of heavy precipitation the aircraft ran into an electrically active region.

3. This incident is not a good example of what would occur to a Long-EZ in a lightning strike. A "full threat" stroke would likely have

ripped a hole a foot in diameter through the composite and vaporized small diameter control cables and interconnecting wiring. The accompanying shock waves would have caused extensive internal damage, delamination, etc. I doubt very much whether the aircraft or pilot could have survived such a strike.

Recommendation

1. Continue to warn pilots of this class of aircraft to stay VFR and avoid "weather" clouds, precipitation and icing within 5 degrees of the freezing level should especially be avoided.

2. This Long-EZ should be thoroughly inspected to be sure that there has not been damage to any internal metal parts. All internal parts should be inspected. It is quite probable, for example, that this strike burned some strands of control cables, electrical wires, etc.

Thank you for sharing this interesting account with me. Please give me a call if you have any further questions.

Yours truly,
J.A. Plumer, President
Lightning Technologies, Inc.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Doug Shane's fuselage on the gear - note that the firewall is not installed yet.

Centersection and right wing. Level-board is bondo'd and must remain in place until wings are drilled and cured to centersection.

Centersection bondo'd to work bench with both wings strapped in place, ready to drill wing attach holes.

Centersection is level laterally and aft face is plumb. Wings are strapped to centersection with ratchet/nylon straps.

Wing/centersection/wing assembly bolted together and ready to install in fuselage.

Wing/centersection/wing assembly is floxed into fuselage. Note that this assembly is "sighted" to align perfectly with canard. Firewall being "buttered" with flox prior to installation.

Lumber bondo'd from fuselage to centersection spar to firmly locate it while it is taped in place.

Generous bondo "blobs" will hold centersection firmly, but only if you sand the glass where the bondo goes.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dennis Riehm's recently completed Defiant. Construction started August 1, 1984. First flight, December 5, 1986. Flight characteristics are delightful - very stable and easy to land.

Ted Roger's new Defiant taxi's in after uneventful first flight.

John Martin's beautiful new VariViggen. We are anxiously awaiting John's first flight report.

Donald Douglas' Long-EZ ready for final contour and paint.

Douglas' wing/winglet juncture - this is how it is supposed to look - very sanitary work, Don.

George Best gives Mike a cockpit checkout.

Look at that instrument panel! Mike said there was nothing he would have changed - everything was exactly where it should be.

George Best's gorgeous Defiant, quite the best we have seen.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Herb Abrams with his very innovative Solitaire engine installation.

Herb's Solitaire engine/prop seen from the cockpit. This Solitaire should climb like a homesick angel with that reduction drive and huge prop!

Herb's ultra-sanitary engine installation. Doors close absolutely FLUSH.

Monty Betts' Solitaire fuselage. First one out of RAF-approved supplier, FeatherLite Products owned by Larry Lombard and Michael Dilley. It truly is "feather light".

Nelson Millar, Fostoria, MI making the obligatory first flight around his yard.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Seen at the Columbia, CA flyin: Sally cleaning some bird ---- off the top of the winglet of her Long-EZ. So that's how you do it!

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 54. If you are building from 2nd Edition plans you must have newsletters 18 through 54. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 54. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 54. If you are building a Long-EZ you must have newsletters from 24 through 54. If you are building a Solitaire, you must have newsletters from 37 through 54. If you are building a Defiant, you must have newsletters 41 through 54.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please have your serial number ready. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

WHAT HAPPENS IF YOU SELL YOUR PROJECT OR YOUR PLANS?

ILLUSTRATION OMITTED

Note: The licensee, not RAF, is responsible to the new manufacturer. If you sell a completed aircraft, you may be liable for any manufacturing flaws. If you sell a partially completed aircraft, you may be liable for any flaws in your work. If you sell your project, or even just your plans, you are ethically responsible to provide builder support and to pass on safety information.

LICENSE TO BUILD RAF AIRCRAFT

Those of you who are active builders know that your purchase of plans from RAF, entitles the holder to apply for a license to allow him to construct one aircraft from the purchased set of plans. Plans sold without the license indicate that the purchaser has obtained to plans for the purposes of using as a book or educational material to learn fabrication or design processes but not to build an airplane of this specific design.

When RAF had been selling plans, RAF had accepted transfer of the license from the original purchaser to a second party, when that transfer was requested. However since mid 1985 when rights to the RAF designs were sold agreements specify that RAF support only those who are previously licensed to build the RAF designs and we cannot issue further licenses for any further production of the designs. In order to provide the best possible service to those licensed to build the aircraft with the remaining funds available for support we must insist that the support be limited to only those who are legally building the aircraft ie; those who have obtained a license to build one of the designs from RAF.

We are aware that there are instances where people are fabricating an EZ without a license from RAF. If those people have gotten information or authorization to do so from one of the licensees it must be made clear as to what the licensees' responsibilities are. Keep in mind that the individual that has obtained a license to build a Long-EZ for example, has the permission of RAF to copy the RAF prototype Long-EZ for one airframe. He is the aircraft manufacturer and he is using certain design information purchased from RAF as well as other design information that he has generated himself or obtained elsewhere. There is no such thing as a conformal amateur built aircraft since there are no official conformality drawings accepted by the FAA or anyone. The FAA thus assumes that each aircraft is indeed a new type and does not have to conform to specific drawings or manufacturing processes. The drawings and manufacturing processes to be used on each airplane are totally the decision and right of the homebuilding manufacturer.

Now if you as a licensee wish to discontinue your project and sell it to someone, the new buyer is dealing with you the licensed manufacturer, not with RAF. RAF's responsibility is to support the individual that has the license, not a third party. Thus keep in mind that if you are selling a project, don't expect that RAF can or will provide builder support to the person buying your project. That responsibility rests with you the manufacturer. You are then effectively licensing the third party to produce an airplane of which you own all manufacturing rights. It is strongly suggested that if you do sell a project, either a completed airplane or a partially built airplane or a set of plans, that you contact an attorney and have him draw up an agreement between yourself as manufacturer and the new party whom you are authorizing to build an airplane and be certain that the agreement provides you with some release or indemnification from liability should that aircraft ever be completed and flown. Keep in mind that you are ethically obligated and responsible to the person who has trusted you for that information and that he may need continuing support to allow him to operate the aircraft safely. If you own a license from RAF, RAF will provide the support to you, however, it is your responsibility to pass that on to the individual that you have your own agreement with.

SCALED COMPOSITES RECENTLY COMPLETED THE NEWEST OF BURT'S DESIGNS, THE ADVANCED TECHNOLOGY TACTICAL TRANSPORT (AT3).
The 62% scaled, proof-of-concept, twin, turboprop was designed to operate STOL from unimproved runways and to have high performance to fill the void between the larger C-130 transport and helicopters.

Scaled Composites' chief test pilot, Fitz Fulton (former NASA test pilot and flyer of the 747 with shuttle), made the first flight on December 29, 1987, and all subsequent flights to date. Burt said it was the cleanest, most successful first flight the company had

---

ever had. Mike Melvill, with Burt as observer/photographer, flew chase in a Beech T-34C, a civilian version of a single engine turboprop (550 hp) Navy trainer. The AT3 uses a novel, tandem wing design linked by the nacelles of its turboprop engines. Each high-aspect ratio wing has extensive fast acting trailing edge flaps which are lowered late in the take-off run to boost the aircraft into the air. The entire proof-of-concept aircraft is constructed of composite materials.

Performance goals for the full scale AT3 include a low altitude, unrefueled range of 2400 nautical miles, a cruise speed of 326 knots, and a payload of 14 troops plus 5,000 lbs. of cargo. Maximum gross take-off weight would be in the 50,000 lb. range.

BURT'S "CATBIRD" FLIES JAN 14, 1988
This very sleek little 5 place tractor airplane is powered by a Lycoming TIO-360-C1A6D, 210 hp with turbo charger. A Hartzell constant speed prop is on the front end. This airplane was the last airplane Burt designed at RAF before Scaled was bought out by Beech and RAF stopped selling plans. It has been a "back burner" project ever since then. Michael Dilley built the plugs and made some of the fuselage molds before he left RAF to go to work with Larry Lombard at FeatherLite Products.

Bruce Evans (Voyager's crew chief) came in to help and between him and Mike Melvill, the rest of the fuselage molds were completed. Larry Lombard and Mike Dilley made the plugs and panel molds for the wing panels, and Bruce Evans did most of the work on the vertical and horizontal tail surfaces. Slowly but surely, the Catbird took shape. For the last year or so the crew at Composite Prototypes, Jim Shultzman, Ray Ratzlaff (both Long-EZ builders) and Greg Garrett have brought the project to completion. On January 13, 1988, Mike Melvill conducted low-speed taxi, high-speed taxi, and runway lift-offs in ground effect. This afternoon, Jan. 14th, Mike taxied out accompanied by Burt and Doug Shane in the Duchess chase plane. Three more runway flights were conducted to verify the pitch trim position. Finally, Mike pushed up the power, it was time to fly! She rotated at 50 KIAS, lifted off at 60 KIAS. Climb was flown at 80 KIAS, to 8000 feet. All the tufts behaved just as Burt said they would, flying qualities are excellent, engine temperatures were optimum.

One hour later, with the gear retracted, Mike flew two low approaches for the large crowd of Scaled Composites and Composite Prototypes

employees assembled on the ramp. Then put the gear down and landed smoothly on Mojave's runway 7. "Catbird" Burt's latest design has flown and it is good - look for this one in the 1988 CAFE 400 Efficiency Race.

VOYAGER - ON DISPLAY IN THE NATIONAL AIR AND SPACE MUSEUM, WASHINGTON, D.C. - DECEMBER 14, 1987
Almost all of the Voyager volunteers were there - it was a great time of remembrance - the Voyager looks magnificent, her wing tips ground away and tattered, just as they were when she landed. She hangs in the entrance within a few short feet of the original Wright flyer, the X-1 and the X-15. Lindberg's Ryan is close, too. A fitting place for the Voyager and a tribute to her brave crew and to the volunteers and VIP's who helped her do it.

On the morning of December 14, 1987, exactly one year after that exciting early morning takeoff at Edwards, Jeana and Dick hosted a breakfast for several hundred of the VIP's at the Grand Hyatt not far from the museum. A moment we will all remember for a long time was when Dick called for silence at exactly 8:00 am, Mojave time. Then he described the takeoff roll, from brake release to lift-off, an unbelievable 2 minutes and 4 seconds it took. Sitting on comfortable chairs in the hotel, it was hard to imagine what it must have felt like to roll for that long before lift-off. The wing tips dragging, the radio calls from the chase and ground control - quite a moment, quite a thrill. Jeana, Dick and Burt, as well as Mom and Pop Rutan, said a few words. A very special breakfast - we were glad to be there.

That evening, Teledyne Continental hosted a party right under the Voyager in the National Air and Space Museum for about 500 people. Mostly Voyager volunteers, VIP's (Voyager's Impressive People) and sponsors of the Smithsonian Institute. A band played. The champagne flowed, delicious treats were passed out and everyone had a ball. The Voyager display, including a video of the whole thing from beginning to end, is really fine and well worth a visit if you find yourself in D.C.

After the official opening of the Voyager display at NASM, we got taxi's in the rain and returned to the Grand Hyatt. There we had a grand "family" dinner. It really was a great time - a chance to meet with friends we had made during the record-setting flight. We would not have missed it for the world.

Joan Richey
Who answers the phone here at RAF on Tuesdays and Fridays? Some of you probably think it is still Sally or Trish. No so, they both work for Burt over at Scaled. It is Joan Richey, VariEze pilot and wife of Chuck Richey. Between them, they built one of the early VariEzes at their home in Las Cruces, New Mexico.

Just over five years ago, they quit their jobs and moved to Mojave where Chuck went to work for Burt at Scaled Composites.

Joan co-owned and operated an FBO on the airport at Las Cruces before coming to Mojave and has flown a number of different general aviation airplanes as well as their EZ. We were fortunate to have Joan write us an article on an incident she had when the canopy opened in flight on her EZ while she was flying solo, (See CP30).

Joan is a storyteller and, when she is scheduled to tell stories at the Mojave library, you better get there early if you want a seat - she is great!

With her knowledge of EZ's and her business background, we are lucky, indeed, to have her working here at RAF. She types the newsletter, handles all the mail as well as answers the phone - so next time you call, say hello to a fellow EZ pilot, Joan Richey.

Correction/Retraction - OOPS!
We goofed in CP53, page 2. In our story of John Koch and Ed Roman's trip around the world, we said they had had a bad experience in Thailand - WRONG, Thailand was great, it was TAIWAN that was bad, and both agree that they would never go back there. They would return to Thailand in a minute and they called to request that we correct our mistake. We are sorry for the error.

Mike Melvill will be out of the country on vacation from Jan. 25th to Feb. 25th. Builder support will be very limited during that approximately four week period. Joan will be able to support any CP subscription-related problems, and Jim Shultzman, a Long-EZ builder/flyer will be available for routine questions. Burt is only very occasionally available, but if anyone had a serious structural or flutter related question, Joan may possibly be able to put you in touch with Burt.

Mike will be visiting family in South Africa and hopes to visit some of the Long-EZ/VariEze, builders in that country while he is there.

JOHN BENJAMIN - NOVEMBER 27, 1987
Any builders who have visited Oshkosh will be familiar with John Benjamin's excellent airplanes.

We first knew him when he flew a Whitman Tailwind with a pretty hot engine in it. Later, he built what was probably the most accurately built VariEze, ever. He also had a "breathed on" engine in this beautiful airplane, and it was fast!

John bought a set of Long-EZ plans after getting a back seat ride in Mike and Sally's Long-EZ and built a really beautiful example, "Plane Vanilla", using a Lycoming 0-235-L2C. John made the firewall a couple of inches wider than plans, otherwise is was plans, stock. The contour and attention to detail were typical "John Benjamin" - essentially perfect.

John worked hard to help other builders and was responsible for making Sensenich propellers available to all homebuilders.

We are very sad to have to report that this quiet gentleman has passed on. John suffered a fatal heart attack on the 27th of November, 1987, while on a hunting trip. He will be sorely missed.

We, at RAF, would like to join all of our builders in sending our condolences to John's family.

"The airplane will always try to tell you before it lets you down." This is a well remembered statement Dick Rutan always preached at RAF when he worked here. Many, many times we have found it to be so very true. The problem is to recognize and act on the information.

A classic case in point occurred a few months ago with Burt's Defiant. N78RA had always had lower fuel pressure on the front engine than on the back, at least as long ago as any of us could remember, even after we installed the 180 hp engines and constant speed props. Lately though, it seemed the pressure was even lower. On the way to Oshkosh 1987, Burt said he had only 2 psi on the front and 6 psi on the rear. Must be the gauge, right? Wrong! On the approach into Oshkosh, the pressure dropped to 1 psi. Mike and Sally moved into very close formation, looking for any sign of a fuel leak - nothing.

On the trip back from Oshkosh, the fuel pressure hung between 1 & 2 psi. The engine seemed okay though, so Burt pressed on. A few weeks after the return from Oshkosh, Burt and Tonya decided to take two friends to Big Bear for lunch. The take off and climb to 300 feet were normal. Then, suddenly, the front engine began to die. Burt was frozen for a second trying to determine if he should turn back and land - should he shut it down and feather it? What?

He happened to glance at the two fuel pressure gauges - the rear was at 6 psi, the front was showing ZERO! He reached down and cross fed the front engine to the rear engine fuel tank - instantly, the front engine recovered and returned to full power! This airplane had been trying to tell us for a couple of years that something was wrong, but no one was listening.

We knew now that it was in the left (front) fuel system. We checked all the screens and filters - nothing. Finally we pulled out the fuel lines themselves and there we found a blockage of foam chips, small pieces of fiberglass and tiny fragments of micro and epoxy. This blockage was fully 4 inches long in the fuel line from the left tank to the fuel valve, right at the fuel valve. We replaced all the fuel line in the airplane and now we have 6 psi, front and rear, at all times.

The moral of the story is this: If you notice anything unusual, pay attention, the airplane may be trying to tell you something. A new noise, a "different" vibration, any change in fuel or oil pressure, don't ignore these things - remember Dick's teachings, "The airplane will always try to tell you, before it zaps you!"

P.S. The accumulation of debris was caused when we had to replace two low-level light switches in the aft sump tank in Burt's Defiant. Apparently, we were not careful enough when cleaning out the tank before closing it. Burt's sump tanks do not have screens in them, the assumption being that the screen in the main tank should do the job.

Similar Problems in a Long-EZ
Marc Borom, N966EZ, writes that he had had many engine hesitations, slight rough running periods, some requiring the use of the boost pump to make it run smooth. All of this was during Marc's first 25 hours in his test area. Needless to say, Marc was rapidly loosing confidence in

his new Long-EZ. How would he ever be able to fly cross country in this thing?

He called us here at RAF several times and we had long discussions about his problem. Finally, one day he decided to make a short cross country to visit a fellow Long-EZ builder.

During this flight, the engine literally quit each time he shut off the boost pump. He asked himself, "Am I having fun yet?" The answer was an obvious - NO!

Safely back on the ground, he once more broke down the fuel lines aft of the firewall. Same results, no problems downstream of the gascolator. Then he remembered that when he had done his fuel flow checks, the fuel flow was sluggish at the gascolator (the airplane was trying to tell him!). He mentioned this fact to other pilots who persuaded him that it was due to low fuel "head" pressure with the nose down. He put that important data point aside as probably not being pertinent.

With no other clues, it was time to check the fuel lines forward of the firewall and back to the sumps. He disassembled the gascolator and found he could blow through both lines from the valve to each sump with very little effort. While he had the system apart, he decided to check the line from the fuel valve to the gascolator. To his amazement and horror, he could not blow through this section of fuel line. He had, at last, found the source of his problems.

He called RAF to discuss this problem and we suggested he use shop air to blow the line clear. The blockage cleared itself with a loud "POP". What he found was a 1" long plug of foam and fiberglass chips that had backed up behind a needle of epoxy coated fiberglass that had lodged in the first sharp bend in the aluminum tube.

This problem was very similar to Burt's problem in the Defiant, and it re-enforces the necessity to "listen" to your airplane. When she tries to tell you something, don't ignore her, check it out and you will become more confident in this machine you have built. In time, you will come to trust her and, therefore, enjoy her and to get more utility out of her. Remember, she will always try to tell you.....

Suggested Method of Checking Static Fuel Flow
VariEze, Long-EZ and Defiant - Before first flight, and if you are now flying but have never done this check, we strongly recommend a fuel flow check. Disconnect the fuel line at the carburetor and hold the airplane in the normal level flight attitude of approximately 1-1/2 degrees nose up (a 24" level with a 5/8" block under the rear end of the level on the top longeron will give you this attitude). Now, using a stop watch and a bucket, turn the fuel valve on for two minutes. Weigh the bucket of fuel, then weigh the bucket empty. The result is the weight of fuel that flowed in two minutes. Since a minimum of 10 gph for a VariEze is required, you should have at least 1/3 gallons (2 lbs.) of fuel in the bucket after a 2 minute run.

For a Long-EZ, you need a minimum of 12 gph, so you should have .4 of a gallon or 2.4 lbs. (without the electric boost pump running). This should increase to a minimum of 16 gph with the boost pump running, or

1/2 of a gallon (3.2 lbs.) in the bucket after 2 minutes. Remember to check both tanks in a Long-EZ, left and right.

For a Defiant you need a minimum of 14 gph (NO boost pump), 0.46 gallons or 2.8 lbs. in 2 minutes. With the boost pump running, you should see a minimum flow of 18 gph, or 0.6 gallons or 3.6 lbs. in two minutes. Don't forget to test both tanks as well as cross feed on both tanks.

These flows are fairly arbitrary, but are flows we have tested for and measured on each of the above aircraft. You should get at least, and probably better than, these numbers when you test your own airplane. If you are way down on these numbers, you should disassemble the fuel lines and blow through them to check for a blockage. Use caution blowing through lines that go into fuel tanks. High pressure shop air might rupture a fuel tank even with the fuel cap removed.

This fuel flow test should be conducted on any new airplane and it would not hurt at all to retest at each annual. Keep in mind that foam chips tend to float on the surface of the fuel and may not get into the fuel lines for a long time or, at least, until you run that tank very low or all the way empty.

N78RA, Burt's Defiant
During a short flight test the other day, we performed the following test. At 7,500" MSL, outside air temperature 21 degrees C, we shut down and feathered the front engine and pushed the back engine to full throttle (22.4" manifold pressure) and best power mixture (peak EGT), We showed 121 knots indicated at an indicated 12.7 gph on the digital Alcor fuel flow indicator. The best we saw on the tachometer was 2550 RPM even with the prop control all the way forward (max RPM). This computes to a true airspeed of 139 kt (160 mph) giving 10.9 nmpg (12.7 smpg).

Next we reversed the process and shut down and feathered the rear engine, pushing the front engine to maximum power (23.4" manifold pressure), the prop to maximum RPM and the mixture to best power. This yielded 108 knots indicated at

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12.7 gph with 2625 RPM. This gave a true airspeed of 125 knots (144 mph) giving 9.8 nmpg (11.3 smpg). The 1" difference in manifold pressure may be an anomaly in the gauges or, more likely, some difference in the intake/filter system, also influenced by the front prop "blowing" air into the intake.

These numbers printed here are for Burt's Defiant, N78RA, which is not representative of the plans-built Defiant. His airplane has a shorter canard as well as a wing span and, therefore, has a different drag polar. These numbers are for the sake of interest only. If you want to know what your airplane will do single engine, you will have to perform your own tests and document the information in you own owners manual.

As in all tests involving single engine flight in a twin engine aircraft, there is an element of risk. For testing such as this, you should have plenty of altitude and wear a parachute. Review your engine restart procedure before shutting down an engine, and be ready to restart if the one running stops running - you all be careful, hear?

P.S. You will notice that inspite of all modifications suggested by the Hoffmann factory, plus some ideas of our own, we have been unable to get these constant speed, feathering props to hold full (2700) RPM once the engine oil is up to the normal operating temperature of 180 degrees F to 210 degrees F. This is one of the main reasons that the Hoffmann props have never been officially approved by RAF for installation on a Defiant.

HOMEBUILT WING-LEVELER (SINGLE AXIS AUTOPILOT)
We saw it at Oshkosh 1987 - Navaid Devices, Inc., single axis wing leveler/turn coordinator which can track a VOR and/or a Loran. I have known the designer and owner of Navaid Devices, Doug Spears, for several years now. He has been flying his VariEze for quite a number of years and he developed this little autopilot specifically for his own VariEze. He has been flying it in his VariEze for over one and a half years. He has done some pretty impressive testing of this device and, when he showed it to me at Oshkosh, I was very interested. The entire system weights only 2-1/4 lbs., including the servo actuator and turn coordinator/computer! Amazing! If you replace your electric turn coordinator or needle-and-ball with this auto pilot, you may actually reduce the weight of your EZ by a small amount!

Sally and I have been thinking about installing some sort of wing leveler in our Long-EZ for some time now. We have looked into the Century 1 and the S-TEC auto pilots, both excellent systems, but, frankly, out of our price range. Doug Spears' little autopilot is in the form of a kit, something like a "Heathkit", and you will have to build it yourself. It is about 1/3 of the cost of the simplest S-TEC single axis system. I believe Doug will build it for you if you are willing to pay him extra for his time, but I would strongly recommend that you do it yourself - it is fun!

Our kit arrived in the mail and I began to read the assembly manual. There is really no way to go wrong! The manual is quite the best thing of this kind I have seen. It leads you by the nose, step by step, and as you get each step done, you check it off - when you have all the steps done, it is ready to test!

The quality of the circuit board and components is first rate. All you need is a small soldering iron and a small pair of side cutters, available at Radio Shack, and you can easily put the whole thing together is a few evenings of your time. It took me four evenings, working, perhaps, 3 hours each evening. I work slow on things as intricate as electronic gadgets such as this. This line of work is not my strong point, but I must say, I really did enjoy putting the kit together.

I followed the instructions exactly and tested it per the book, using a car battery and battery charger and a digital voltmeter, which I borrowed from work. The installation into a Long-EZ or VariEze is straight forward - the most time consuming thing for me was threading

the wiring from the panel to the engine compartment. By the time I had it installed and working, it took most of a Saturday.

First flight to test it, Sally went with me to watch for traffic while I had my head down calibrating the five (5) little trim pots that must be adjusted in flight. It worked perfectly, first time! But only for a short time - alas, I had done something wrong and it glitched! I could not figure it out, so I called Doug and he had me ship it back to him. He checked it out thoroughly and found where, in spite of my care, I had soldered a capacitor into one of the circuit boards backwards! What a bummer! Anyway, he shipped it back all nicely calibrated and it worked perfectly, right out of the box, requiring essentially no adjustment.

The wing leveler is really neat - now I can easily fold and unfold maps without having the airplane roll over! It does not have a heading hold feature, however it will do a very nice job of tracking a VOR and an even nicer job of tracking Loran in the approach mode! Really amazing, the silly little machine does a better job than I can do!

Doug does not recommend his autopilot for IFR use, he designed it for the day, VFR, sport pilot, to make your cross country flying more enjoyable, and it certainly does that. Don Shupe, founder of the VariEze Hospitality Club, has recently installed one in his VariEze and he is ecstatic about his. I really believe the thing is a great safety device since it does allow you to spend more time navigating, checking your map and your check points.

If you ever did inadvertently end in a cloud or fog bank, it would keep you upright and fly you back out into VFR conditions.

Used in the tracking mode, it will fly a much straighter course than an average pilot would, thus saving time as well as gas. I am very, very pleased with mine and I would recommend it for anyone flying an EZ and, for that matter just about any type of homebuilt. For more information contact Doug Spears. He really is a neat guy and is very knowledgeable and sharp on autopilots in general - and especially the lightweight one he designed.

Contact: NAVAID DEVICES, INC.
241 Signal Mountain Road
Chattanooga, TN 37405
1-615-265-7809

Rough River Report
"The sun was slowly sinking behind the Kentucky hills and already several rows of EZ's were tied down for the night. It was Friday evening - the start of the Fly-in at Rough River Dam State Park.

The event began with a Friday evening reception at the lodge for early arrivals followed by Saturday morning out on the ramp. Many builder were given the opportunity to take their first ride in an EZ. Norm Howell, with the help of Byron McKean, conducted a first rate forum on formation flying.

Then the buses came and took us away to Mammoth Cave National Park. We climbed up, down and around the caves and passages on a 2 hour tour.

It's really good exercise for those pilot-types. After exploring the natural underground landscape, we returned to Rough River to a wonderful outdoor dinner on the lake front.

Sunday's air features were dog fighting and aerobatics in EZ's - a real pleasure to watch. In the evening was the Sunday banquet and get together.

For the weekend, we had over 80 participants and 25 EZ types. The winners of our competition were:

Best VariEze	Steve Wright
Best Long-EZ	Martin Kennedy
Best Interior	Arnie Ash
Best Modification	Darrell Craig (strake windows)

Buzz and I do not look at ourselves as tour guides. We just make the arrangements for the fly-in and everyone shows up and has a good time. We want to thank everyone who came and joined our group of enthusiasts because it's you who make the fly-in and it's great getting to know everyone and the low-down on your planes. Everyone wants to make this a repeat performance for next year. Scheduled dates are Sept. 30, Oct. 1 and 2.
by Peggy Talbot"

IVCHC Honoring "Pop" George & "Mom" Irene Rutan!
Over 40 EZers showed up at Flo's Cafe, Chino Airport, CA on New Year's day for the Club Fly-In which was dedicated to George & Irene Rutan, IVCHC Historian, for their "50th" Wedding Anniversary!

The remarkable celebration of the Rutans' special occasion lasted from 8:00 am to around 1:30 in the afternoon. The arrival of these EZs gave the tower and the local residents more thrill than the Rose Parade & the Rose Bowl - UFO's on New Year's Day!

IVCHC would like to thank the following EZers who participated in the Fly-In.

(In random order) From CA - George & Irene Rutan of Palmdale, Wes & Millie Gardner of Redlands, Bruce & Bonnie Tifft of Mariposa, Les Faus of Van Nuys, David & nephew & Trevor Orr of L.A., Eric Cobb & Dan Mason of Santa Monica, John Lambert of San Diego, Emedine & Earl Haguewood of Huntington Beach, Erin Haggard of S.F., Bill Oertel of Norco, Gai & JoAnne Cadwell of Brea, Sally & Randy Randall of San Diego, Bill & Julie Lermer of Spring Valley, Steve Irvin of Hawthorne, Mike Henderson of Long Beach, Bob & Doris Ohletz of Riverside, Jimmie & Ferne Hays of Chula Vista, Clayton Kau of Rendodo Beach, Klaus Savier of Fountain Valley, Don Converse & his friend, Don & Bernadette Shupe of La Verne, and Dan Thompson of Cathedral City; From ID - Art & Bonnie Lazzarini of Hailey: From IL - Jake & Tip Bach of Carbondale; From KS - David & Mable Haggard of Wichita.

IVCHC wishes everyone a "HEALTHY" & "HAPPY" EZ flying year - 1988!

INTERNATIONAL VARIEZE AND COMPOSITE HOSPITALITY CLUB
IVCHC was founded in 1979 by Donald and Bernadette Shupe of California to encourage and promote hospitality, travel, and support for builders and pilots of VariEze and Other Composite aircraft.

A Quarterly Newsletter is published that contains letters from members on safety, first flight reports, builders hints, and information on past and future club fly-ins.

A list of members is published yearly with quarterly updates. These are provided to all members but they are CONFIDENTIAL and are NOT to be duplicated, posted, or shared for any reason with nonmembers.

Members are expected to provide emergency assistance, shelter and comfort to other members according to their ability to do so. Courtesy demands as much prior notice as possible of an impending visit to the host by visiting dignitaries. The major complaint we get from members is that they are not visited enough. Members who are still building especially treasure talk, examples, and occasional rides.

Club members have frequent lapses of sanity and take on the task of hosting a fly-in. They have complete freedom to do this when and where they please. All we ask is that they take credit for their accomplishment and simply send us the notice for the flyin and a report after the event (and perhaps recruit a few new members).

IVCHC hosts a Fantastic Banquet at Oshkosh each year with an average of 240 attendees. A few well established and successful fly-ins are ones like New Year's Party at Chino, CA; the Rough River Dam and the Brookridge Airport Fly-In by Buzz Talbot et. al.; Jackpot Air Race by Shirl Dickey (Shirl started his own group - R .A. C. E. in 1987); In 1979 Bruce & Bonnie Tifft organized the "IVHC Bahamas Fly-In" and in 1987 Mike & Sharon Bridges organized the second "Bahamas Fly-In"!

IVCHC members support other members by lending, replacing, and repairing parts and extending aid and comfort to any member who has become stranded in their vicinity. Members who have been helped are only expected to replace whatever they have borrowed and cover any expenses of the helping members.

When people visit you, they are expected to cover all their own expenses including food and transportation. It should not cost you to be a host. The most common hosting task is to pick people up at an airport, provide a bed overnight or two, sometimes a meal or two, and then take them back to the airport so they may continue their journey. (We recommend that everyone gets a telephone call # to use when they are traveling & visiting).

It is very comforting to know that no matter where you are in the world, if something should go wrong or you need a place to stay there will be a member within a few hundred miles. Help is never far away if you keep an IVCHC Membership List with you while you travel.

If IVCHC sounds like an organization that may fit your needs and interest, please join us by sending your name(s) phone #s, address,

airplane type & N#, (you must be a pilot and a homebuilt builder or owner to join), home airport, date of 1st flight, and anything you think might be helpful to us, along with a check for $17.00 domestic (U.S.A. & CANADA) or $20.00 OVERSEAS, and mail to:

SHUPE/IVCHC
2531 College Lane
La Verne, CA 91750

In 1978 we, the Shupes, were lucky enough to have Burt Rutan's blessing in starting the "IVHC" and it was he who put our little note in the "CP" to get us our very first "twenty" members. Today we have 240 current members (since memberships are accepted on the basis of per airplane, we actually have plus or minus "480" people in the club), and seven of the original twenty are still with us. Because of the purpose and nature of our club, we know that we have the most unique, friendly, fun, interesting, nice and delightful people in our club. And we have also been able to keep the size of our club fairly small and stable for the last several years.

Those of us who choose to provide our services to such a small and specialized group are not in it for the "MONEY"! We; as well as Dick Kreidel of Long-EZ Squadron No. 1, Dave Orr of Long-EZ Squadron No. 2, Al Coha of San Diego EZ Squadron Marshall Gray of EZ Builders of FL, and the newest but one of the fastest growing groups - Arnie Ash of Central States; simply enjoy providing our services to a bunch of pilots who are crazy enough as we are to build and fly our own homebuilts.

BUILDERS HINTS

NOSE GEAR SHOCK STRUT SPRING REPLACEMENT
Several builders have reported a 3 to 5 knot reduction in nose wheel lift off speed after replacing the "sagging" old LST spring as called out in CP51. The easiest way to remove the LST spring is to leave NG-3 and NG-5 attached. Remove the retainer bolt nut and, with the gear in the extended position, have someone push down on the nose. You can now easily lift out the retainer bolt and the shock strut will come apart for easy replacement of the LST spring. Look for wear on the retainer bolt, replace the bolt if there is any sign of grooves worn into it. Look for sharp edges on the LST-2 slotted holes, dress these down with a smooth file if necessary. Apply a generous quantity of grease to the shock strut before re-assembly. If your nose gear shock strut comes off the extended stop when you get into your EZ, you need a new LST spring which is available from Ken Brock Mfg.

Nose Gear Shock Strut
Reference Long-EZ plans, 13-2, and CP25, page 8
The rod ends used on the shock strut can be either RE4M6, REP4M6, or HM-6. RE4M6 and REP4M6 are functionally and dimensionally equivalent, the difference being the RE4M6 are "new surplus" with solid metal seals, and the REP4M6 are of new manufacture with Plyo-Seal or Teflon seals.

The major difference between the "RE" rod ends and the HM-6 rod end is the diameter of the hole machined into the ball of the rod end. The "RE" rod ends have a 1/4" diameter hole in the ball, while the HM-6 rod end comes with a .3750 (3/8") diameter hole.

The "RE" rod ends can be used "out of the box" because you will be using AN4 (1/4" dia.) bolts through the rod end ball. The HM-6 rod ends, however, need a bushing to reduce the bore size from 3/8" to 1/4". These bushings can be ordered from Aircraft Spruce along with your HM-6 rod end for an additional $1.00 each. The Wicks catalog does not list the required bushing, however, they may be available upon request.

If you desire to make the bushings yourself (as I did), it's a very easy task. First, get ahold of a piece of 3/8" OD x 1/4" ID 1015/1020 steel bushing stock. Both wicks and Aircraft Spruce carry this item for under $2.50 per foot. The bushing stock I ordered was a perfect slip fit into the HM-6 ball, however, the 1/4" ID was a little undersize. A 1/4" reamer took care of this problem in short order. The length of you bushings should be slightly less (approx. 1/16" less) than the width of the ball. After cutting the bushing stock to the approximate length with a hack saw, chuck the bushing into your drill and face the ends of the busing with a metal file, until the bushing is the proper length. The whole process took me less than an hour.

It is much simpler to use the "RE" rod ends instead of the HM-6's with bushing, however, there is another factor you should consider before you make you decision. PRICE! A quick comparison of the price difference between the HM-6's and the "RE's" will show a savings of over $16.00 each in using the HM-6's, or a savings of over $32.00 for the two required for the shock strut."

The above sent in by Stet Elliott who has been working hard on a complete computer printout of all CP's from #24 to the present, listing all hints and changes in chapter form. We are looking forward to this and will announce it in the CP when it is available.

EDITOR'S NOTE: If you have a 'heavy' Long-EZ or you are on the heavy side, you would be wise to increase the AN4-15A bolt to an AN5-15A. This would require drilling and reaming the 1/4" hole in NG-3 and NG-4 to 5/16" and you would need to drill and ream the HM-6 "bushings" to fit a 5/16" bolt.

Easier Long-EZ Wing Removal
During the construction period, after wings have been installed and before the strakes are closed out.
You may be surprised how many times you will install and remove your wings during this time. To make it easier on yourself, using a 1-1/4" diameter hole saw, open the 1/4" diameter pilot holes in the forward face of the centersection spar to 1-1/4" diameter to allow yourself to get your 3/4" socket wrench through the forward face of the centersection spar. Of course, these 1-1/4" diameter holes must be filled with PVC foam plugs and glassed with 2 wet plies of BID before you close out the fuel tanks/strakes - don't forget, or you will have an unbelievable fuel leak!!

Make the job of installing your main wings easier - sent in by Mike and Nancy Mayo. The problem is that it is difficult to align everything,

then push in the bolts and keep the spacer washers on the bolts. A small piece of styrofoam, such as a piece of the round core you cut out of the foam blocks for the wiring conduit holes, is ideal. Cut to the right length and jam into the wing attach bolt access holes such that the outboard two bolts are held firmly in place, including any washers required. Wing rigging then becomes an easy task even for only two people, one at the wing tips and one at the root. The root person holds the inboard wing attach bolt in place while the wing is slid into place. A neat, simple way to do what can be a rather frustrating job.

Shaping the Fuselage - Dana Terrill sent this one in. Using a small Hitachi electric hand plane, he was able to carve the fuselage to match the template in just a few minutes, see photo. Skill, Stanley, Black & Decker, etc., all make handheld electric planers which will cut through the PVC foam, the fiberglass and wood longeron (even the firewall and F-22 bulkhead) like butter. Experiment a little with depth of cut, 1/16" works quite well. This can be a big time saver and will allow you to make a nice clean job.

A quick fix for the pilot's vent or NACA scoop. This idea sent in by new Long-EZ builder/flyer, an Englishman working and living in France, N.W. Ruston.
"I used two 1/8" diameter pop rivets to attach a rectangle of the flexible black neoprene/asbestos to the bottom lip of the NACA inlet. The width of the rectangle should be such that it is a tight fit in the NACA inlet." **SKETCH OMITTED**

By pushing part, or all, of the rectangle into the inlet, you can adjust the air flow easily and simply from zero to 100% air flow - neat idea.

NOSE WHEEL/FORK ASSEMBLY ATTACH
The plans call out for (4) AN525-10R24 screws to attach the NG-15A nose gear casting to the 'S' glass strut. As we have reported previously, a really hard landing can pop the heads off these AN525 screws allowing the 1/8" aluminum plate to separate from the NG-15A casting which allows the whole nose wheel/fork/pivot assemble to depart from the strut! We strongly recommend that these AN525 screws be replaced by AN3-14A bolts. These are much stronger and the heads will not pull off as they can do with the AN525.

We have called out this recommended change before but we still get occasional builder/flyers who did not get the word and have ended up with this failure. It is an easy fix - can be done in a few minutes and it can save you much grief and frustration.

HOW TO REMOVE AND REPLACE SLICK MAGNETOS EASILY ON A LYCOMING POWERED VARIEZE OR LONG-EZ
Have you ever spent an hour just trying to remove or replace the distributor cover on you magnetos? I have and it is very, very frustrating. The main problem is removing and replacing the three (3) slotted-head screws that hold the cover on to the mag. The magnetos are so close to the firewall that it requires a 90 degree screwdriver to get at the screws. Getting the screwdriver into the head of the screw when you cannot see the screw is very difficult, maddening, and time consuming. You can probably tell I hate this job on my airplane

and, over the years, I have had to do it more times than I care to remember.

I don't know why it took so long to figure it out, but as I said, the main problem is the three slotted-head screws in each distributor cap. So the easy way to cure that problem is to go to Allen head screws! So simple, yet so effective. I bought 100 screws, they are stainless steel, flat head, socket cap screws and are 10-32 thread, 1" long. It took 20 minutes to remove 3 of the original screws and less than 1 minute to install all 3 of the new Allen screws. I fitted each screw on to the short end of the 3/32" Allen wrench, reached around the mag and simply wound the Allen wrench round and round with my finger until it was tight! Astonished me how easy it was to do!

I do not know of a source of these screws in lots of 6 which is all you need, but I bought mine from Garrett Industrial Supply. They are made by Soc-Pro and cost $16.00 per 100 which was the minimum order. Perhaps a group of 16 could get together and buy 100 at a time. Or better yet, I have 94 left and I know where to get more. I would be glad to mail a set of 6 to anyone who would like a set and would be willing to send me $1.00 plus a SASE.

Write to: Mike Melvill
Building 13 - Airport
Mojave, CA 93501

Some thoughts on Dynafocal rubber mounts - sent in by Long-EZ builder/flyer, Dick Kreidel, a founding member of Long-EZ Squadron 1 in the Los Angeles basin.
"As you may or may not know, the Lord mounts, Barry Control mounts, (even the cheaper imitations such as sold by Aircraft Spruce) have a stamped hole in the metal ring that is bonded to the rubber sandwich. The purpose of this hole

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is to index the rubber/steel bonded sandwich mount to the welded Dynafocal motor mount to prevent it from rotating as the bolt is torqued up, and also to correctly orient the spacer. On all Cessna and Piper mounts I have seen, there is a 1/8" diameter x 1-1/4" long roll pin pressed into each corner of the Dynafocal ring to engage the hole in the metal of each rubber sandwich. See the sketch below for the position of this pin. **SKETCH OMITTED**

There are four different Lord mounts that will work on an EZ. The main difference is the spacer: Lord p/n J7402-1. Lord p/n J7402-5, Lord p/n J-7402-16, Lord p/n J-7402-24. **SKETCHES OMITTED**

Note that the lengths of the steel spacers are all different resulting a varying pre-loads on the bonded rubber and steel sandwiches. Most EZ builder/flyers in Long-EZ Squadron 1 have found that the J-7402-1 with the rectangular rubber spacer is best for the Lycoming 0-235. I have tried all four with my 0-235 and I, also, found -1 to be best. Currently, I am using the -24 spacer and find it to be satisfactory, however at $260.00 per set compared to about $120.00 for the -1, -5, and -16, they probably are not worth the extra dollars.

One last point, the rectangular spacers for the -1 version are designed to be oriented as shown below for maximum effectiveness. The 1/8" roll pin assures this and prevents torsional windup of the rubber block bonded to the spacer. **SKETCH OMITTED**

According to the Lord Manufacturing Co., provisions must be made to allow the engine to move in its mount up to a maximum of plus or minus 2o25' laterally from a vertical CL (roll). Under thrust loads, it should be able to push into the mount as much as .070". Vertical displacement, under heavy 'G' loads, it should be able to move as much as plus or minus .34" measured at the engine CG, about 15" aft of the crankshaft prop flange. You should be certain that your engine can move up to these maximum call-outs without interference with cowling, baffling, etc." Thank you, Dick, for the effort in obtaining this information.

How to change main wheel axles and fix a loose main gear strut - from Gene Zabler, VariEze N3793X.
"An "A.D." issued in 1985 by RAF called for immediate inspection of Rosenhan axles for cracks and/or broken axle stubs. Thereafter, they were to be inspected every 100 hours. Even though our axles were fine, we decided to purchase a set of replacement 4130 axles manufactured by Stolp Aviation.

With an early, warm spring this past year, I decided to put on new brake pads. The old set had 310 hours on them and were about 2/3 worn out. In the process of changing the brakes, I inspected the axles again. They both looked good. Because VariEze N3793X flys and lands heavy at times, I decided to take the axles off and have them zi-glowed. Both axles were cracked, one all around and the other halfway around on the top side. I had always cleaned them with gas and a brush and still missed the cracks. The new set of axles had to be drilled for mounting holes but installed nicely and we rechecked the toe-in in the process. Now N3793X has new brakes and new heavy duty steel axles.

But, she creaked a little whenever we picked up the nose so I decided to check the gear attachment bolts for hole elongation. This can only be done with the wheels off the floor. I built a jack stand, 2x6's with tripod bases and floating top pad. The 4 gear attachment bolts should be loosened about 2 turns before checking the gear (per RAF), then take a firm hold and shake. We had movement, not a real lot, but decided it was time to install the 5/16" diameter bolts as recommended by RAF.

What a job! Twenty hours later and 4 new bolts, the gear was stronger than new. A few tips follow: A 5/16" diameter twist drill ground down to 1/4 diameter on the first inch to act as a guide through the existing holes. The back end of the drill bit was turned down to 1/4" diameter and glued with 5 minute epoxy into a 80" piece of brass tubing. A 1/4" diameter plug was put into the end so that the drill chuck would not crush the tube. By using the electric drill right behind the front seat with the long brass extension in the drill, drill holes through the rear seat. The lead on the 5/16" drill bit guides the 5/16" drill through the front sets of holes. Do only one at a time so that you don't lose the alignment.

The rear set of 5/16" holes was a real bear. But, by shortening the drill bit to 2" long and borrowing a small 90 degree head electric drill, I enlarged the holes. Another thing, bolts are undersized from .001 to .005.

By holding a whetstone on the cutting edges of the drill bit when it is running, you can make an undersize drill to match you bolts. I took off another .002 for the hand drilling. I then lubed the bolts and pressed them in. No more loose gear.

We thought the information the the gear tab bolts might be helpful. If anyone is still building a VariEze, I would suggest installing the 5/16" diameter bolts or use the 1/4" bolts, but install 3/8" OD x 1/4" ID x 1/8" long steel bushing in the 1/8" extrusions while the plane is still in the shop."

FeatherLite Fuel/Baggage Strakes
Doug Shane has just completed the installation of a set of these strakes from Larry and Michael in Boonville, CA. Doug was skeptical of his ability to do a nice job on the strakes and was almost reluctant to start on the project. Ultimately though, there was nothing else left to do, so he went for it!

It was easy! He was amazed, the pre-formed leading edge sections were easy to fit to the fuselage and wing root. Hot Stuff was used to temporarily located them in position while the prefab ribs were trimmed to fit. Most of the trimming and fitting was done at the centersection spar forward face, then Hot Stuff was again used to jig all the ribs, baffles, and baggage compartment walls into place.

Doug cut each of the top and bottom skins out of a single piece of 3/8" H-45 Divinycel PVC foam and glassed the inside face. Then the whole assembly was broken down and permanently glued together with flox, after sanding judiciously in all the appropriate spots. This framework was allowed to cure. The bottom was then floxed into place using straight pieces of 2x4 lumber at the leading and trailing edges with 1x2 lumber "legs" to the floor of his garage to hold the bottom skin firmly into place and this was allowed to cure. All plumbing, vents, drains, etc., were installed per plans and the top was floxed on after a heavy coat of epoxy was painted everywhere in each tank. (Don't neglect to do this or your tank will leak.) The top was held in place with weights until cured. A little careful sanding and each strake was ready to be glassed on the outside. A rather simple way to do a difficult job, and they really do look nice. The leading edges are a very nice shape and will probably hold a little more fuel than a Task strake or a homebuilt strake. Doug would happily recommend the FeatherLite strake kit and hes says if he can do it, anyone can!

Doug's Long-EZ is now into the messy finishing and wiring stage. Engine has been installed and he and Mike Melvill have built a custom cowling, in place, on the airplane. See photos of Doug's strakes in this CP.

Electric Primer For Long-EZ

While this is not a new idea, it does seem to work well. Mike and Sally recently installed an electric solenoid valve into the primer system of their Long-EZ, N26MS. This simple, on/off valve allows them to use the electric boost pump to prime the engine while the starter is cranking, thus getting the fuel into the cylinders where it belongs.

These little electric solenoid valves are available in 12 volt as well as 24 bolt. They are manufactured by Skinner, the part number is: B2Dx62 (12 volt or 24 volt). You must specify the voltage. An excellent source for these valves is:

Norman Equipment Co.
Bridgeview, IL
Toll free, call: 1-800-323-2710

The Skinner valve must be placed in the primer line such that it can allow fuel, under pressure from the boost pump, to enter the primer lines to each of the cylinders.

Mike made a simple "T" fitting which he installed in the fuel line between the boost pump and the engine-driven mechanical pump. He was unable to find a suitable off-the-shelf "T". The problem is that the primer lines are dash 2 (1/8") size, whereas the fuel line downstream from the boost pump is dash 6 (3/8"). Therefore, the "T" would have to look like this: **SKETCH OMITTED**

If anyone knows of a source for such a fitting (in steel), please let us know and we will put in the CP. Mike made his "T" fitting like this: **SKETCH OMITTED**

5/8" x 5/8" x 1" drilled and tapped with one 1/8" NTP thread, and two 1/4" NTP threads. This worked fine, if a little heavy. **SKETCH OMITTED**

The B2Dx62 Skinner valve should be wired to a momentary switch on the panel near the starter switch. This lets you crank the engine and "blip" the primer as required. Of course, the boost pump must be on for this to work.

Why an electric primer? Well, first of all, it eliminates having primer fuel lines in the cockpit. It is simple and lightweight. This system is commonly used on general aviation aircraft, for example, the Beech Duchess (BE-76). The only disadvantage we can think of is if your battery was flat you could not prime the engine to allow you to hand prop the engine. This system may not be as good on an engine with no starter. It is primarily intended to be used in conjunction with an electric starter. Mike is very happy with his and he knows of a least two other Long-EZs with the same installation and they work great as well.

ACCIDENTS/INCIDENTS
An Anchorage, Alaska Long-EZ pilot took off from Merrill Field one afternoon with about 2 hours fuel on board. He flew to nearby Birchwood Airport where he practiced takeoffs and landings for almost an hour. Then he headed back to Merrill Field at 2,000 feet (required to cross above the approach corridor at Elmendorf Air Force Base). He intended to switch tanks over Elmendorf, but when he ran into low

ceilings and had to descend to 600 feet to cross under the approach corridor, he forgot. During the descent from 2,000 feet to 600 feet, he was at hard idle and was cleared for a straight-in to Merrill Field's runway 18. Seeing that was was going to be a little bit short, he added power only to find that the engine had quit.

Too late to switch tanks and restart, he was committed. A tiny 550 foot long empty lot was in front of him and he went for it. Nose gear down, landing brake down, and put it down firmly on the end, too short to finesse the touchdown. The nose gear NG-15A casting failed and the nose gear strut dug into the soft field. He rolled/skid only 225 feet! The Long-EZ stopped short of a chain link fence between the empty lot and 5th Avenue's busy traffic in downtown Anchorage! No other damage occurred to the plane or pilot.

This pilot's recommendation, based on this incident? Post a landing check list on the panel and use it religiously every time you land - a very good suggestion. This is at least the second time an incident such as this has occurred with Long-EZs. Good as they are they can not fly if the pilot screws up. Learn from this close call and use your check list. You may not be as lucky or as skilled as this Alaska pilot.

SHOPPING
Access doors for wheelpants. These 1" diameter, spring loaded doors can be riveted into your wheelpants. They open inward, so that using an appropriate tool, you can check pressure or inflate your tires quite easily without removing the wheelpants. These little access doors are made of stainless steel (which can be polished) by the Cam Loc Company. Bud Myers of Wicks Aircraft has obtained a supply of these high quality parts.

Contact: Wicks Aircraft
410 Pine Street
Highland,IL 62249
1-618-654-2191

Ask for: Part number KM713-16-080 access doors.

(See photos and further details elsewhere in this CP)

NACA, canopy vent doors and light weight front wheel fenders. By now most of us are familiar with Gene Zabler's neat, quality vent doors and fenders. Gene tell us that he has not had a price increase since he introduced these parts more than four yours ago. Increased costs of materials and shipping costs have forced him to raise his prices. The vent door will now cost $7.50 p.p. and the front wheel fender will not cost $40.00 p.p. If you have not tried one of Gene's simple, easy to install, vent doors, you owe it to yourself to try one, particularly at this time of the year. The nose wheel fender can really extend the life of your prop by helping to keep small stones and gravel out of the prop during taxi, take-off and landing. Write to: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
1-414-886-5315

FOR SALE
1979 Lycoming 0-235-L2C. 1940 hours, set up per Long-EZ specs. All accessories are either new or factory re-manufactured. $3,500.00.
Contact: Grant Ross
36 Walnut Drive
Morgan Hill, CA 95037
1-408-778-3578

Epoxy ratio pump (for Safe-T-Poxy). Used, but fully functional. $100.00 (Canadian).
Contact: Doug Osborne
230 39th Avenue, SW
Calgary, Alta., T2S OW5
Canada
403-243-3653

Wood prop for 0-200 Continental VariEze (Great American Prop), Multilaminate, like new, cost $400.00, no waiting, $370.00. Pair of Cleveland 500 x 5 wheels and brakes PN# 40-78B and 30-9. Used 80 hours. Cost $300.00, sell $195.00. Westach gauges. 3-1/8" tach (0-3500), 4 cylinder 3AT3-2. Cost $60.00, sell $30.00. 2-1/4" voltmeter, PN# 2A5. Cost $33.00, sell $20.00. 1" suction gauge. Cost $50.00, sell $25.00 Contact: Phil Wimberly
4020A Verdent Street
Los Angeles, CA 90039
1-818-246-7946

12V infrared, quartz electric cabin heater - never used. $60.00.
Call: Larry Dodge
1-303-860-4357

Original 500 x 5 Cleveland wheels, brakes and axles for Long-EZ. $225.00 Contact: Michael Blais
168 Bradford Avenue
Napolean, Ohio 43545
1-419-592-1659

RAF QUARTERLY SPECIAL
We get such tremendous response from you that we know you must read every word of the newsletter - so here's an item that many of you may not know we have.

"Wings of Glass", a short (less than 10 minutes) video of the most glorious EZ flying you have ever seen, accompanied by soothing, soaring music. This is a "sit on the couch with the lights down low" kind of tape. You'll want to watch and listen with someone you love. Done for RAF by Ferde Grofe. VHS only, no BETA $15.00

We still have the poster of all of Burt's designs and they can still be autographed. A must for any builder. $15.00 plus $3.00 for postage, shipping and handling.

Arnie Ash, founder and editor of the Central States newsletter, is attempting to get a group of VariEzes and Long-EZs together for a group

flight to the Sun and Fun Fly-In in Lakeland, Florida this year. Anyone interested, please contact: Arnie Ash
RR 5
Davenport, IA 52806

Aircraft Spruce
P.O. Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
P.O. Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90580
714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

PLANS CHANGES

VARIEZE PLANS CHANGES

DES Check the static flow of your fuel system per the method shown in this CP.

LONG-EZ PLANS CHANGES
LPC #133 DES Check the static flow, as well as the flow with the boost pump running per the method shown in this CP.

SOLITAIRE - NO PLANS CHANGES

DEFIANT PLANS CHANGES

All Defiant builders should have received a four (4) page nose gear modification information package in the mail - we mailed it in October of 1987. If you did not receive one, please let us know and we will mail another to you.

DPC #45 MEO
In the above package, the tubing wall thickness call-out for NG-3 was wrongly called out as .065. It should be .095 as called out in the plans as well as CP 53, page 4.

DPC #46 MEO
RUD-3G failure potential at the point where the steering arm RUD-18 rod end bearing bolts on. This failure occurred on Dr. George Best's Defiant. The fix for this potential point of failure is to weld a small plate above RUD-3G to RUD-3H (see pages D-40 and D-42) to sandwich the rod end on the end of RUD-18. This puts the bolt through the rod end in double shear and eliminates the bending loads on this bolt which eventually fatigued Dr. Best's RUD-3G.

DPC #47 DES
Before first flight, check the static flow of your fuel system on both tanks and on crossfeed. Also, check static flow with boost pump running as shown in this CP.

SKETCHES OF DEFIANT RUD-3 WELDMENTS AND RUD-3X OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dana Terrill's Long-EZ fuselage, after a few minutes work with the small Hitachi electric planer - bottom of photo.

Burt's slick new speedster "Catbird" flying over the Mojave desert.

A factory fresh, new Mirage 2000 flies over the French countryside with Lieutenant Real Weber's new VariEze in close formation - note the enormous difference in angle of attack!

CARTOON OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

"Pop" George and "Mom" Irene Rutan were honored by IVCHC on their 50th Wedding Anniversary on New Years day at Chino Airport, CA. (IVCHC Photo).

Bob and Dot LaBonte trying their Defiant on for size. Bob built a very nice Long-EZ some time ago.

Fitz Fulton, left seat and Jon Marion right seat, taxiing in after the first flight of the 62% scaled proof-of-concept AT3.

Rough River Fly-In, the crowd gathers at a forum on formation flying.

Don Foreman, left seat and friend in Don's brand new Defiant. The first Defiant outside the USA. Don also built the first VariEze and the first Long-EZ in England.

Cory Bird drove Mike and Sally's VariViggen all the way to Seattle, Washington and delivered it to the Museum of Flight. Cory is a friend and co-worker at Scaled Composites.

'Catbird' - 5 place high performance single over the windmill farms on the Tehachapi mountains.

Don Foreman's NG-2 Defiant nose gear retraction link - now that's beefy!

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

FeatherLite leading edge fuel/baggage strake, ribs and baffles installed in Doug Shane's Long-EZ.

Prefab rib kit is cut essentially to size, requiring only a little trimming to fit.

Baggage compartment walls, baffles and ribs come prefabbed.

Access door seen from inside wheel pant.

Leading edge fuel/baggage strakes come glassed on the inside.

Wheel pant prepared for installation of Camloc access door.

Camloc access door, cleco'd in place, ready to rivet.

Access door riveted in place, ready to paint.

Spring loaded, Camloc access door, available from Wicks Aircraft Supply.

Air tool to inflate tire, simply line up valve and push in the Camloc access door.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

'Catbird's' spacious instrument panel.

Sculpturing a foam plug for Doug Shane's Long-EZ cowling.

Steve Harmon's Long-EZ.

Dennis Riehm's Defiant instrument panel.

Bayard DuPont's Defiant.

Doug Spear's wing leveller servo actuator, mounted on Mike and Sally's N26MS centersection spar - capstan drives ailerons through 1/16" cable.

W. N. Hubin, Kent, Ohio.

Jim Stanley's very complete Long-EZ instrument panel

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Burt's new 'CATBIRD' - a turbocharged, pressurized, high performance 3-surface airplane. A 5 place retractable, with a forward swept 'T' tail and wet wings, designed for high altitude, high speed, fuel efficient transportation - First Flight, January 14, 1988.

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If you are building a VariViggen from 1st Edition plans you must have newsletter 1 through 55. If you are building from 2nd Edition plans you must have newsletters 18 through 55. If you are building a VariEze from 1st Edition plans you must have newsletters from 10 to 55. If you are building a VariEze from 2nd Edition plans you must have newsletters from 16 through 55. If you are building a Long-EZ you must have newsletters from 24 through 55. If you are building a Solitaire, you must have newsletters from 37 through 55. If you are building a Defiant, you must have newsletters 41 through 55.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please have your serial number ready. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF send a stamped, self addressed envelope along if you have any questions. If you are placing an order, it's best to keep it separate from a request for an answer to a builder question. Mark the outside of your envelope "builder questions". This will speed up your reply.

RAF - BACK IN BUSINESS?
In the February issue of Sport Aviation there was an article quoting me as saying that RAF was being "re-activated". This has caused quite a bit of confusion in that many have inferred that it means we were again planning to market plans for homebuilt aircraft construction.
Actually, the comment was referring to statements I made at the Voyager reunion party in Washington in which I mentioned that the Catbird had once again become a RAF project and that RAF may do some projects in the future such as a man-powered helicopter or man-carrying ornithopter.

I am still very busily and happily employed at Scaled Composites in Mojave, California next door to the old RAF building and together with a bunch of engineers and builders (a staff that includes many of our old homebuilt aircraft buddies) working heartily away at some very interesting airplane development projects. I have every intent to continue to pursue that job for the foreseeable future as it is one that is being done in a very creative environment and involves some very interesting projects such as the design and fabrication of the wing for the wing-masted catamaran for the America's Cup challenge race this fall.

You can find out about some of the other Scaled projects in the Aviation Week magazine. RAF projects are primarily in the category of things we like to do as hobbies. However, RAF does have one full time employee, Jim Shultzman, who's been preparing the Catbird for its test program and will be preparing it for the CAFE race this year. Most of you know that Jim is the builder of a Grand Champion quality J-3 Cub restoration as well as a Champion quality Long-EZ.

The RAF projects are not funded by plans sales or by any commercial customer. All the funding for the recent years and next years activities have come from income that I have received recently by making an occasional lecture to engineering groups and aviation industry groups concerning the developmental aspects of the Voyager.

Back in mid 1985, we announced that instead of cashing in the RAF bank account when we decided to no longer market plans, we would use that money to provide builder support as long as we felt it either necessary for the continued safety benefits of assisting current builders, or until the money ran out, which ever cane first. I am very happy to report that the cash health of RAF has remained approximately the same throughout this nearly 3 year time period even though no plans sales have been made since July of 1985. The major reasons for this are that RAF moved out of the shop and into a small room, has for the most part only part time employees, has not had any liability expense, and we have been able to continue the sale of items other than plans. The poster sales alone (the eighteen Rutan-designed airplanes) paid for our Oshkosh trip last year. Joan Richey, our two-day-a-week RAF manager, is currently looking for another product we could sell at Oshkosh '88 to allow us to continue to support the Oshkosh show. This important forum allows us to communicate with so many builders and flyers regarding all the support requirements. The pilot's bull sessions at Oshkosh on the flight line continue to be attended just as well as they were when they were first introduced at Oshkosh in 1978.

My specific activity in the homebuilding arena is very limited because I have to do it essentially on hobby time. I plan to continue to attend the Oshkosh convention indefinitely and have given up golf so I can have the most time available to enjoy my favorite hobby.

I would like to say that I will some day re-enter the homebuilt aircraft marketplace with a new design. However, while the demands of Scaled Composites development projects exist, I an unable to predict that for the foreseeable future. We had predicted that RAF would last only two or three years as far as its ability to provide builder support to past customers. Now, however, nearly three years into our post-business time period, we still are not aiming at a particular time

in which we must stop builder support. I think that it is important to remind you that your support of RAF and your purchasing the things that we can sell is the reason we're still around. I'm certainly hoping for your continuing support so that we can continue to provide the best homebuilder service available for as long as we can. Thanks again, and we'll see you at CAFE, Jackpot and Oshkosh.
Burt Rutan

BURT'S CATBIRD (MODEL 81) UPDATE
The Catbird is in the midst of a careful flight test program to establish the performance and flying qualities, and an acceptable flight envelope. The airplane is a true delight to fly. So far the three pilots who have flown it have been impressed with its handling qualities "out of the box". A few minor changes have been made, but so far it looks quite promising and we are proceeding with plans to enter the Catbird in the CAFE 400. Burt also plans to fly the Catbird to Jackpot, NV and race it in Shirl Dickey's "The Bull _ _ _ _ Stops When The Green Flag Drops At Jackpot" race. We have not opened the low altitude speed envelope yet, so at the time of writing this, we have really not got much idea of what she will do in a "Jackpot" or "Wendover" type race. Our preliminary data shows that the Catbird should be quite competitive in the CAFE 400 and we are looking forward to the June 25th efficiency contest.

The Catbird is a 5 place single engine, with the pilot sitting up front on the centerline. The next row of passengers sit on either side of the pilot but aft about 15", the 4th and 5th passengers sit back-to-back with numbers 2 and 3, facing aft. The airplane is a very low drag, low wing with a forward swept "T" tail and a small canard near the firewall. The turbocharged Lycoming 4-cylinder, TI0-360, 210HP engine turns a two bladed Hartzell constant speed prop. At cruise rpm, this is a very quiet cockpit and the view is superb. Rate of

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climb is a very respectable 2,000 fpm through 16,000 feet. Top speed is _ _ _ _, well, you'll have to wait for Jackpot or Wendover to find that out!! The good news is that we are still having fun out here in the desert and that is what it is all about.

LONG-EZ SQUADRON II HOLDS AN ENGINE SEMINAR
This enthusiastic group of Long-EZ builders and flyers organized a really great weekend of seminars on the engine, its installation, instrumentation, etc. We would like to compliment Squadron II for their initiative in setting up such a project.

Several experts we on hand to lecture on the various subjects covered and Burt Rutan was the guest speaker at the end of the very full weekend of lectures and talks. From feedback we have received, this was a very popular program and was extremely informative, educational, and practically helpful to all those who are building, and even those flying. We would heartily recommend this idea as an excellent one for any of the EZ clubs or groups to organize for the benefit of their members.

The aircraft engine, its installation, and its operational requirements are all subjects that are not often talked about in any set of plans in any great detail, and many homebuilders get into this area of their project with great temerity and very little knowledge of what they are about to attempt.

Great idea - Congratulations, all at Squadron II for a great job well done.

MIKE'S TRIP TO SOUTH AFRICA
I was very fortunate to be able to spend a month with my mother and sister and to visit with old friends and relatives not visited in over 16 years. It was a really wonderful vacation and I enjoyed it immensely. One of the shining highlights of my trip was a very special Sunday spent with a group of EZ builders in the Johannesburg area.

Herbert de Graaf picked me up early and took me to his home to look at his Long-EZ project. I had met Herbert at Oshkosh 1987 and it was good to see him again and to meet his wife, Ellie. We then drove out to the Grand Central Airport where a large group of homebuilders were crowded around two excellent examples of Long-EZs. Dave O'Neil was kind enough to invite me to fly his really beautiful 0-235 powered Long-EZ. So, with Dave in the back to make sure I did not get lost, we taxied out. Grand Central is at almost 6,000 feet elevation, so these EZ builders really do understand density altitude. February in South Africa is essentially mid-summer, so with Dave and I and about 30 gallons of gas, the take off run was quite long. However, the Long-EZ got off and climbed well. Piet van Rensburg, and EZ builder from Pretoria, had taken off before us, so we joined up on him for a formation, low approach. The control tower was most co-operative and OK'd several low approaches.

Flying over the countryside where I was born was quite an experience, a very beautiful place. After we landed, Piet van Rensburg who has a larger engine in his gorgeous Long-EZ suggested that I fly his and another homebuilder who owned a C-210 Centurian offered to carry a few photographers up while I flew close formation in Piet's Long-EZ. Lots of fun.

After taking a bunch of photos, we landed and drove to the home of Chris Carstens, a Long-EZ builder and an employee of South African Airways. Chris is one of the most meticulous craftsmen I have met and his almost completed Long-EZ is, without a doubt, a potential grand champion. A number of EZ builders, their wives and friends were at Chris' house and they laid on a fabulous barbecue for me which I enjoyed tremendously. Later that evening, I showed a bunch of slides and a video of the Voyager world flight. Everyone seemed to enjoy themselves, I certainly had a great day, one I will remember for a long time to come. I only wish I could have met with every builder or flyer in the country while I was there. Unfortunately, time did not allow this but, thanks to Herbert, Piet, Chris and all the others I met, I believe I was able to give some constructive criticism and advice. I must say, I am very impressed with the general quality of workmanship I saw, and even more impressed with the "stick-to-it-ness" that people overseas seem to have - and, indeed, have to have in view of the difficulties involved with obtaining materials and parts.

To all I met while I was there, many thanks for the great day you made for me - for all I was unable to meet, I am sorry. Maybe next time!!

BURT'S BIRTHDAY FLY-IN AT MOJAVE, JUNE 18,1988
Come to Mojave and join in the fun. David Orr and Sally Melvill are organizing the event which, in the past, has drawn enormous numbers of EZs to the Mojave Airport. The fly-in will start around 10AM on Saturday morning, June 18th and your landing will be your attempt at winning the spot landing contest, so shoot for the white line! Soft drinks and hot dogs will be available but please bring a side dish. This is an opportunity to visit the place where all of our airplanes were designed, built, flight tested and developed into what they are today. Meet with Burt and all of the builder/pilots who fly in. It's a chance to compare notes, shoot the breeze and look at more EZs than you will see anywhere on any one airport. Come join the fun on June 18,1988 - FLY IN, DRIVE IN, WHATEVER, - JUST COME!

FOURTH OF JULY WEEKEND FLY-IN AT JACKPOT, NEVADA
Organized for the past 5 years by Shirl and Diane Dickey, this fly-in is one of the highlights of the year. The organized events consist of: EZ RACES for stock VariEzes, LONG-EZs, 0-235 VariEzes, and all others (unlimited); spot landing contest, and ribbon cutting contest. Pool side cocktails, a dinner/show on Saturday evening, an Awards banquet on Sunday evening with Cactus Pete's Casino putting up $1800.00 for prize money (paid to the first 5 places in each class). Call 1-800-821-1103 for reservations, $38.75 plus tax per night. Last year we had 57 EZ's on hand, and a great time was had by all - come and join us!

WILLIAMS AIRPORT, WILLIAMS, ARIZONA
July 10, 1988. Fly in to this beautiful part of the world and join the fun with the local EAA chapter from Flagstaff/Williams, Arizona area. This is a fly-in breakfast, so get there early Sunday morning. The bacon, eggs and sausage were sensational last time we went.

BONNEVILLE 125 AIR-RACE
August 19th, 20th, and 21st at Wendover, Utah. The Stateline Hotel Casino has agreed to contribute $100.00 per airplane on the ramp (up to a maximum of $3000.00) for prize money for the EZ Races which will be held like the last two years across the historic Bonneville Salt Flats. Call 1-800-648-9668 and ask for RACE/IVHC block reservations. Shirl and Diane Dickey have organized a Spot Landing contest, a Ribbon Cutting contest, The EZ Races, a Dinner Social on Friday evening with the Awards Banquet on Sunday evening. For more information, call Shirl Dickey at 602-893-8711. Help get the maximum prize money - fly in to Wendover for a truly great weekend of fun.

ROUGH RIVER DAM KENTUCKY FLY-IN '88
SPONSORED BY:
INTERNATIONAL VARI-EZE HOSPITALITY CLUB
-AND-
CENTRAL STATES ASSOCIATION
SEPTEMBER 30 - OCTOBER 2, 1988

The third expedition to the north central hills of Kentucky has a NEW DATE: Friday September 30 through Sunday October 2.

We think the earlier date will increase the probability of warm weather, and most club members didn't have Monday, Columbus Day, as a holiday from work and therefore were leaving on Sunday.

One thing that hasn't changed is the great food and rustic setting of one of Kentucky's best state resort parks. With lodge rooms looking over the tree lined lake, and the park's 2800' paved airstrip a short walk from the lodge, club members overwhelmingly voted to return each year.

This Fall we will again feature Saturday morning forums

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on the ramp and rides for builders. The "EZ Formation Flying" forum was so popular that many pilots have asked for more, so we are trying to put together an "EZ Aerobatics" forum.

The Mammoth Cave trip is again on for Saturday afternoon. But this year we have reserved a completely different tour of the 300 mile long cave. The "Frozen Niagara" tour features decorative dripstone formations and towering stalactites and stalagmites that cascade in a wall of color frozen for thousands of years.

Reservations with the lodge should be made EARLY by calling 1-800-633-9744, be sure to tell the operator you are with the fly-in group as they have reserved rooms just for us. A 15% group discount will be applied to your room bill.

In addition, if you will be going on the cave tour, please mail me a $10.00 per person, (children free), deposit for the bus. Tour tickets are $3.50 per person, (children $1.75, under 6 free), purchased the day of the tour at the cave. The final bus cost will be determined the day of the trip based on group size.

For a park flyer, airstrip diagram, and event itinerary mail a self addressed, stamped envelope to:

Buzz Talbot
22 Sunshine Drive
Bolingbrook, IL 60439
or call: 312-759-1124 evenings

FELLOW IVHC MEMBERS, VariEze/Long-EZ builder and aviation enthusiast, Ivan Shaw and his lovely wife, Judith, have been in Southern California for more than two months now. Ivan has been working on a project mutual to his company in England and Scaled Composites here at Mojave. His sharp English sense of humor has been much enjoyed by all of us here at RAF and we will miss them when his project comes to an end in a few weeks. For some of the time they have been here, they have been staying with Mike and Sally who have really enjoyed them and enjoyed showing them some of the highlights of the area.

Ivan is a very sharp fellow and built one of the first VariEzes to fly in England. He has since converted it by installing a Long-EZ centersection, wings, and winglets into a - Vari-Long? Since that time, he has gone one step further and designed a neat retractable main

gear and installed two 77 hp engines on the wings to make, what he calls, a Twin-Eze but what looks a bit like a tiny Starship.

See below for Ivan's own words on the subject. He only has about 10 hours on his Twin-Eze so far, so he is still faced with a major developmental flight test program when he returns to England. We have printed a photo of his beautiful little creation in this CP. Ivan says he is not sure what he will do with it after he has completed all testing and he does not really want to be inundated with inquiries while he is going through the test program.

Ivan and Judith have been amazed at the freedom we have here in the good old US of A. How easy and economical it is to fly somewhere, the freedom to design and build and fly almost any kind of airplane. These freedoms, that used to exist in England but sadly have been virtually eliminated by the bureaucracy, must be jealously guarded by all of us who live and work in the US. It takes a visit from a fellow EAA-type from a foreign country to point out to us how fortunate we are here in America and to remind us to do all we can to protect our rights and to make sure the "can do" spirit that we have here does not become a "no can do" situation like it has in so many other countries. When EAA asks us members to write our congressmen regarding something important like the latest attempt to restrict private flying as shown in the Sport Aviation magazine, support the cause, write in, make your voice heard. If we don't, our precious freedom to fly will slowly be eroded away until it no longer exists. As Ivan says, "watch out for the bureaucrat to nibbles away at your freedom". How true!

Excerpt from Ivans letter to Mike Melvill

"Dear Mike,
Please find enclosed a photograph of my latest project, the Shaw "TwinEze", thought you may be interested.

G-Ivan started life as a VariEze that I built in 1980-81. After 350 happy hours flying, I decided to convert it to a Long-EZ then, inspired by Starship, got carried away with twin engines and retractable gear.

The engines are British fully certified units - three cylinder, inline, water cooled, two strokes giving 77 bhp at the prop. They were designed and built my Mike Hewland for the ARV Super Two aircraft. Both engines have completely separate systems, batteries, etc. and left fuel tank feeds left engine, right feeds right.

To date, I have completed approximately 10 hours flying with the only problems being getting the cooling air to go where I wanted it to go and some fuel vapour (sic) locking that has only been completely cured by running on 100LL instead of MOgas. The good news is that it flys superbly, just like the Long-EZ, the noise level and vibration is less. Control on a single engine could not be easier, 350 fpm climb and a VMCA wings level of 56 knots on the critical engine. I have not opened up the envelope speed-wise yet but one thing I am sure of and that is it's going to be fast. The main gear is a retractable unit of my own design that tucks the wheels aft through 115 degrees to where the engine used to be, it is powered by hand hydraulic.

The technical challenge has been everything and more that I expected. The bureaucratic hassle has been something you have to live through to believe. After static load testing the aircraft to 5 g's, gear drop tests to beyond FAR part 23 requirements, engine mount static load test, 25 hours of ground running, taxi, runway hops, my approved inspector clearing it as airworthy, after all this, it took a further six months to get permission to commence a test flight program. I was actually told that I could not do this because, "it has not been done before". What a sorry state of affairs for a country that once led the world in innovation.

My flight testing continues. I will keep you updated on my progress.

Thanks, Burt, for the inspiration,
Ivan Shaw"

REFUELING FIRE
"I knew it was possible, but surely it wouldn't happen to me. How many thousands of times have EZ's been refueled without any incidents of fire? One reported in Norway (see CP 52 and 53) and now me. Why does it happen? It is carelessness, or is it preventable?

After a 40 minute flight in my LEZ N8HA, I called for the fuel truck and parked on the ramp with the nose headed into an 8 knot breeze. The fuel truck drove up and was parked about 8 feet behind the plane - downwind. Gary, the driver, unreeled the ground cable and clipped it to the exhaust stack, just the same as we had done about 30 times before. Gary then brought the fueling hose around the left wing and I removed the left tank fuel cap. Eleven gallons of (100 LL) fuel was pumped into the tank and it was about an inch and one-half from being full. He then shut the nozzle down to slow the flow and with both of us looking directly at the fuel tank opening, the fumes from the tank started burning. No explosion. The flame above the tank was a couple of feet high and was being blown across the wing aftward about 4 to 6 feet. I remember seeing the end of the fuel nozzle positioned even with the fuel tank opening and in the center of the 3 inch flush filler ring when the fire started. We don't know if the nozzle had touched the ring or not. The nozzle was also on fire.

By very fast reaction and a dry powder extinguisher from the rear of the fuel truck, we had the flame out in about 12 seconds from the time it started. Gary had one hand singed and I was spitting dry powder. I had just turned around from getting a small Halon unit in my cockpit when he shot across the wing with the powder. Damage to my LEZ was mostly cosmetic, but with a couple of heat wrinkles in the skin just aft of the filler ring, and some places in the centersection and wing spar area where the finish paint was blistered up from the primer coat. A large area was smoke blackened from the filler ring to the trailing edge. If we had been standing on the downwind side of this operation it may have been a tragedy for both of us.

The main thing I will do for sure is to install a grounding lug onto the metal fuel filler ring and use it instead of the engine exhaust. Also, a jumper groundwire will be clipped to that lug and to the fuel

nozzle BEFORE removing the jumper wire or ground cable. The fuel truck should be parked crosswind from the plane and not downwind of it, and should be grounded into earth rods. The fuel handler should not be wearing any nylon clothing. A two pound Halon unit will be mounted in my EZ and it will be "IN HAND" or "WITHIN ARMS' REACH" each time the plane is fueled. If this fire had burned another few seconds the top of the tank may have melted away and then it might have been uncontrollable.

Alfred Tiefenthal of Norway and I have learned from a first-hand experience. I hope it will not happen again, anywhere, but I am sure that it will - Maybe to YOU, so please be prepared.

Herb Anderson
Montrose, Colorado"

EDITOR'S COMMENT

The above letter was sent in by Long-EZ builder/flyer, Herb Anderson of Montrose, Colorado after he had experienced a refueling fire. The only other case ever reported to us was written up in CP52 and CP53. We have refueled EZ's literally hundreds of times ourselves here at Mojave where it is very dry and static electricity is quite prevalent. You can get a nasty jolt just getting out of your car. For some reason we have never had a fire. Now that we know of two instances, it is obvious that we cannot go on without doing the best job we can to prevent such a disaster.

Refueling fires, surprisingly, are not all that uncommon, even in metal airplanes. In the military, for example, the gas truck is grounded, the nozzle has a ground strap that is connected to the fuel tank near the gas cap before opening the gas cap.

We can learn from this. We are equipping our Long-EZ's with a ground lug which is connected to the gas cap ring. This is where the gas truck will connect his groundstrap instead of onto the exhaust as he usually does. We believe that a ground wire should go into the tank from this ground lug or the gas cap ring such that it is immersed in fuel even when the airplane is parked nose down with minimum fuel in the tank. When we get ready to take on fuel, the procedure will be this: a short cable with alligator clips will be kept in the EZ and will be connected to the ground lug and to the gas truck's fuel nozzle BEFORE opening the gas cap. The gas truck's grounding cable will also be connected to this ground lug BEFORE the gas cap is removed. This will drain any static off the airframe, out of the inside of the fuel tank and also off the surface of the fuel in the tank where static can build up. Then we will open the cap and pump in fuel.

The friction of fuel through the nozzle and pouring from the nozzle to the inside of the fuel tank creates static electricity but this charge will drain away from the nozzle, the tank, and the surface of the fuel through our internal cable and ground lug, as well as through the truck's ground lines.

We are not experts in this area, however, we believe what we have outlined is a good common sense approach to eliminating the threat of a fire caused by static electricity arcing from the fuel nozzle. We are open to suggestions on this potentially serious problem, but what we have outlined above is what we are doing to our airplanes, and we

believe every builder/pilot should do to his or her airplane before the next time you refuel it. In addition, as Herb Anderson has recommended, we will carry a good quality Halon fire extinguisher which will be available to the pilot or person refueling the airplane. Once the refueling operation is complete, the gas cap should be closed and locked before any ground strap is removed.

We would like to thank Herb Anderson for writing his report for the CP. Taking these actions now, before it happens to you, may save you from a potentially very, very serious problem.

SUGGESTED INSTALLATION OF ANTI-STATIC GROUND LUG ON "STANDARD" AIRCRAFT 2" DIAMETER OR 3" DIAMETER GAS CAP ASSEMBLY (MIL-C-7244B)

SKETCH OMITTED

Top skin is spot faced through the ring. A reverse spot face is required to remove foam and glass from under the ring, as shown, to allow the steel tube spacers to clamp up tightly onto the ring for a good electrical contact. Care must be used to avoid contaminating the inside of the fuel tank.

SUGGESTED INSTALLATION OF ANTI-STATIC GROUND LUG ON BROCK FUEL CAP ASSEMBLY

SKETCH OMITTED

Use a Dremel to cut a 3/8" diameter hole through the top skin of each fuel tank adjacent to the Brock fuel cap, as shown. Remove all foam and micro down to the inside skin, but do not penetrate inside skin. Fill this hole with flox - allow to cure. Drill a number 12 hole through the cured flox into the tank close to the edge of the Brock fuel cap ring, as shown. Care must be used to avoid contaminating the interior of the fuel tank.

HIGH ANGLE OF ATTACK DEPARTURE TESTING

Our own flight test experience plus NASA spin tunnel evaluations plus a NASA test pilot's actual attempts to spin a Long-EZ have lead us at RAF to believe that it was virtually impossible to get our airplanes (VariEze and Long-EZ) to depart from controlled flight and enter a classic spin. Recent flight testing conducted here at Mojave by three different test pilots on a research airframe similar in configuration to a Long-EZ, have resulted in the classic spin modes.

While opening the high angle of attack envelope, we discovered that this particular airplane would, indeed, depart and would enter steep upright spins from which it would readily recover, at least in spins of less than 2-1/2 turns. As we cautiously pushed into the unknown, we suddenly found that this plane could also go flat! That is to say, it would transition from a steep spin into a very high angle of attack flat spin, uncommanded.

Recovery was very difficult but a combination of full recovery controls plus power was successful, at least twice. However, in one case, the

engine quit due to high centrifugal forces and, although full recovery controls were put in after two turns and held in for eight more turns, this had no perceptible effect. The pilot then initiated full throw pitch control inputs, attempting to get the nose down. Control input was in phase with a slight pitch oscillation he noticed during the previous 10 turns. The oscillating inputs were successful and after 7 more turns, the airplane was recovered and landed dead stick on the Mojave runway.

This experience was quite a shock to the pilot who did not think a canard configured airplane could enter a flat spin. The chances of recovering from such a spin are usually remote. The pilot experienced some disorientation, the spin rate was as high as one turn each two seconds, or 180 degrees of rotation per second.

What was learned from these experiences? First of all, it may be possible to depart and spin any canard configured airplane, even a plane such as a VariEze or a Long-EZ, particularly if these airplanes were not carefully and accurately built. Do not deviate from the plans. Use care to not accept any modification or variation from that configuration that has been thoroughly tested here at RAF, subtle modification of the wing and winglet may make your aircraft dangerous. Use your absolute best effort to set canard, wing and winglet incidence correctly. Level all waterlines as closely as you can read a level. In other words, build your EZ as accurately as you are capable. Conduct a careful, accurate weight and balance, including measuring the airplane. Do not assume you airplane will be the same as the prototype. Also, your test program must include stall/departure tests of your airplane, flown with a parachute and with plenty of altitude.

Fly your airplane sanely and well within your own piloting skills and ability, and remember that flying is not necessarily a dangerous activity, but it can be terribly unforgiving of any carelessness or foolish judgement.

VARIEZE MAIN WING ATTACH - CORROSION

Since we first reported the corrosion problem in VariEze main wing attach plates in CP53, page 7, we have heard from only two or three builder/flyers who had found signs of corrosion. Just this week, we received a letter from a VariEze owner/pilot who found corrosion in the WA-2-2 plate. He has spent a considerable amount of time and energy removing this plate, in fact, he said he almost resorted to using dynamite! He sent us the WA-2-2 plate, the lower plate of the top two plates mounted to the centersection spar. By far the toughest plate to remove and replace. This plate (see photo) has one of the worst cases of intergranular corrosion we have seen. It is absolutely not safe to fly and must be replaced. Unfortunately, this is probably going to be very difficult, and we honestly do not have any simple fix for this. Just removing the WA-2- plate could do serious damage to the centersection spar. The UND wrap around the end of the centersection spar may have to be cut and removed. The foam under the WA-2-2 plate must be dug out, the 8 AN525 (or AN509) screws must be removed (drilling them out may be the easiest method). A replacement plate must be fabricated, duplicating exactly all of the holes in the plate. This is a difficult job and will require an expert machinist and a lot of patience. Brock will not be able to help you with this. Each case will have to be dealt with on an individual basis. The new piece

should be alodined and then floxed and screwed back into place. If the UND wrap was damaged, it must be replaced, which requires cutting into the fuel tank (we did say it would be tough!).

This is major work, not anything that could not be done by a person who has built a VariEze, but very tedious, difficult work. And it must be done right. There is no short cut, no easy way. If you find more than simple white powder surface corrosion, stuff you can easily polish off with 320 grit sandpaper, you must ground your VariEze and replace the corroded parts.

A mandatory inspection is required before next flight for all VariEzes. So not take this problem lightly, it could kill you and anyone who may be with you. Remove both wings. Clean all visible aluminum parts at the wing root and centersection spar. Look at the edges of all the WA plates on the centersection spar. Look for a thinner edge or a swollen appearance under the glass. Look in between these plates (where the WA-3 tongue slides in). A white powder appearance that can be completely removed and polished out with 320 grit is OK, but the plates should be very thoroughly cleaned and sprayed with zinc chromate. LPS or a good quality grease as used in marine applications should be generously applied everywhere before re-installing the wings. Check the WA-4 pins and the AN4 bolts and grease both thoroughly. Replace the AN4 bolts if they show any sign of corrosion.

New construction VariEzes, or anyone replacing wing attach fittings with new ones, should clean all aluminum parts with Alumiprep 33 or Metal Prep #79 then alodine them with Alodine 1201 which puts a tough, corrosion-resistant, visible, golden finish on. We are reluctant to try alodining parts in place due to the acid etch (Alumiprep 33) possibly getting under the glass onto the aluminum.

When you inspect your VariEze, be very conscientious. Check very carefully, it is difficult to find, you may have to probe under the glass over the WA-2-2 plates. Look hard and long at it before you decide it is safe to fly.

The only good news about this is that where the epoxy was bonded to this WA-2-2 plate which we have, there is no corrosion. The surface of the metal is as new. Intergrandular corrosion is very common in airplanes that live near the ocean.

Sea planes are especially prone and require constant inspection and maintenance aimed at preventing just this problem. The salt in the air plus water from rain or condensation, plus heat and aluminum and, presto!, you have a battery! Galvanic reaction and you have corrosion. Keep the aluminum parts clean, grease them often, and you will have no problems. People who live far from the ocean may not see this problem but they must check for it just the same.

This problem is confined to the VariEze. The Long-EZ wing attachment is completely different and this same problem should not occur. Of course, all metal parts must be protected from corrosion - aluminum with alodine or zinc chromate, steel with zinc chromate (after cleaning in metal Prep). Wing attach bolts and parts should be generously covered with a good grease in VariEze and Long-EZs. Replace any rusty bolts and nuts.

CAUTION - AILERONS FREEZING
Jerry Nibler, an Alaskan Long-EZ builder/pilot tells us of an experience he had near an area known as "the trench". He encountered heavy rain and low visibility while trying to fly north so he did a 180 degree turn to where there were breaks in the cloud cover and climbed up on top. Climbing through the freezing level at 8,000 feet, he noticed the ailerons getting stiffer and stiffer until he could hardly bank the plane at all.

This scared him rather, so say the least, so he did another 180 degrees and descended below the freezing level where the ailerons returned to normal, much to his relief. Jerry thinks the rain water got into the hinges, did not have time to dry out completely before he climbed to the freezing level where, or course, the

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moisture froze. He advises to stay below the freezing level after flying in rain or taking off covered in dew until the airplane has a chance to completely dry out.

This is a good point, one we have mentioned in the CP before but one that should be repeated because it can really scare you if it happens to you. We have had it happen to us in a Long-EZ as well as Burt's Defiant. We found we could control the bank angle well enough to continue by using the rudders and, eventually, the ice sublimated away and we were able to break the ailerons free. We suspect that water runs across the bottom of the wing, bridges the gap between the bottom wing skin and the leading edge of the ailerons, then freezes there. You can help this a little if you keep the ailerons moving left and right as you climb through the freezing level.

Thanks for this report, Jerry. This is the kind of thing that can really help out a fellow EZ pilot. By the way, Jerry ended his letter by saying that his Long-EZ is the most valued of all his material possessions and has provided him with more shear pleasure that anything else he can think of (yes, even more than that! he says).

CAUTION
Friction in the pitch control system of an EZ can make it very difficult to fly. In fact, it can flat-out make it so uncomfortable to fly that you won't enjoy it at all!

Friction in an EZ's pitch control system is easy to avoid and must be avoided. There are so few parts involved that it is simple to check. Disconnect the pitch trim springs, push the stick forward and aft, or grab the trailing edge of the elevator and move it full travel up and down. There should be no perceptible friction. It should not hang up anywhere, it should easily flop all the way up and all the way down. If it feels stiff or tight anywhere in the full arc of travel, find out where it is binding and fix it before you attempt to fly. Check the rod ends at the stick and at the inboard ends of the elevators. Check the stick's pivot points. Check every one of the elevator hinges. On the original GU canard, it is easy to get one or more hinge points too tight. The washers at the hinge points should easily spin. The bronze

bushing should be lubricated and should be a nice easy slip fit on the AN525 screws which are the hinges. Check that the mass balance weights are not rubbing or chafing inside the slot in the canard on each elevator.

Lastly, put a saw horse or chair under each canard tip (well padded, of course) and have someone push down on the nose or center of the canard. Apply enough weight to bend the canard at least 3 or 4 inches up at the tips, then check all of the above for friction or binding or chafing under load. There should be no perceptible drag in the pitch control system (with no pitch trim springs installed) in any of the RAF designs, VariEzes, Long-EZs. Defiants or Solitaires.

CARB AIR INTAKE HOSE PROBLEMS

Jake Bach, a Long-EZ builder/flyer reports that for almost a year he had an unexplained loss of about 100 RPM. He checked everything he could think of - timing, compression, plugs, etc., to no avail. Then he decided to modify his air intake system and when he took the intake hose off (which looked perfect from the outside), to his amazement, it had imploded! All the wire on the inside of the hose had come loose and had balled up in the hose restricting the engine's ability to breathe. A new hose completely cured the problem.

This is another good point, one that has been covered in the CP before and, also, one that, in fact, caused an accident in a VariEze some years ago. Part of the problem is in the installation of the hose. It is critical that the spring wire inside the hose be bent in such a way that it can be securely trapped under the hose clamps at each end. We like to bend the wire 90 degrees so it comes straight out of the end of the hose, then bend it 180 degrees so it comes out of the hose around the edge and back along the outside of the hose. Then the hose is installed over the filter tube or carb intake tube and the hose clamps are slipped on so that the wire and the outside string wrap are held securely in place when the hose clamp is tightened. This should eliminate any chance of the wire "spring" coming loose from inside the hose, however at least an annual inspection of the outside, as well as the inside, of this hose should be conducted.

NOSE WHEEL CASTINGS CRACKING AND DISINTEGRATING

We have had several reports of this problem from Long-EZ and VariEze builders and, as we stated in a past CP, you should remove your nose wheel periodically and take it apart, clean it and carefully inspect it for cracks in the cast aluminum center bearing holder. This is especially true if you have ever experienced shimmy in your nose wheel. We have disassembled and examined all of the Brock nose wheels we have here at RAF and have found no sign of any cracking. However, we have seen several examples that were cracked and several more examples that broke and, in fact, disintegrated.

Wicks Aircraft Supply in Highland, Illinois sells a nose wheel that is a direct replacement for the Brock nose wheel that is built just like a miniature of your main wheels. This wheel looks like an excellent alternative although it is a little heavier. If you have had one crack and are looking for something stronger, give Wicks a call. Ask for NW-A1230 nose wheel, they cost around $50.00, fit the same tire and tube and will mount into the EZ for with a minimum of fuss.

FAA REGULATION CHANGES
Builder identification placards must be installed on your aircraft after March 7, 1988 (if you are flying now without one, you could be violated). According to the FAA, we aircraft owners must have a plate or placard on the exterior of the fuselage adjacent to the rear-most part of the canopy (door!), and it must be legible to a person on the ground. There are no letter or number size requirements and the information must agree with your stainless steel information plate in your cockpit. You are required to display your aircraft make and model designation, (Smith, Long-EZ or a Jones, VariEze, etc.). The serial number must also be shown. You can have a sign writer simply paint this information on the fuselage, or you could stamp it onto metal plate and bond/rivet it onto the fuselage.

If you plan on visiting a foreign country, even Canada, Mexico or the Bahamas as an example, you will be flying through an Air Defense Identification Zone (ADIZ). After March 7, 1988, you will be required to install 12" high registration marks for this trip. These can be temporary marks provided they do not come off during the flight. These are new Federal Aviation Regulations and all aircraft owners, including homebuilders, must comply after March 7, 1988.

ACCIDENT AND INCIDENTS
We have had an indirect report of a Texas VariEze that crashed in Arkansas. One witness reported watching the VariEze take off and disappear immediately into the "muck" - apparently the "muck" (bad weather) snared this VariEze a little later on near Little Rock.

This is a particularly tragic accident because it was easily avoidable. Flying into bad weather in a marginally equipped sport plane like an EZ is a hazardous business. Our fun-to-fly EZ's were never intended to be all-weather capable. Too many EZ pilots seem to think that these planes make us into supermen or women. Far too many EZ pilots are trying to do things in their EZ's they would never have considered doing in their Cessna 150 or Piper Tomahawks. We are only fooling ourselves. If we continue to push our luck like this, we will end up paying the ultimate price and it simply is not worth it.

Used properly, an EZ can be a delightful, economical, high-speed transportation machine - a machine you and yours can get years of enjoyment out of. Used carelessly, an EZ can get you into so much trouble you may be incapable of getting out of it in one piece. Use discretion, good judgement and enjoy.

WEIGHT AND BALANCE
We recently heard of a serious deep stall accident in a homebuilt plane (not a RAF design) in which the builder pilot had not conducted a weight and balance! To quote Burt in CP12, April 1977 - "Now hear this, all of you homebuilders, an inadequate or inaccurate weight and balance could kill you! The final weight and balance you do on your plane before flight testing begins is just as important as installing the wing attachment bolt!" DO NOT NEGLECT THIS CRITICAL FLIGHT SAFETY ITEM.

ACCIDENTS AND INCIDENTS
A Pennsylvania Long-EZ builder/flyer was fatally injured when his newly completed airplane crashed short of the runway on his second flight.

Apparently, the first flight was picture perfect, a flight that lasted about forty minutes. The second flight lasted about the same length of time. His engine was heard to be cutting in and out, on his second approach to land. He started a climbing left turn in an apparent effort to return and land. The airplane spiraled down from about 100 feet and crashed.

The right fuel tank was intact and contained approximately 8 gallons. The left tank was crushed, but the 1:20 minutes of flight would probably have used about 8 gallons of fuel. The airplane had 8 gallons on each side when it first took off. The pilot's shoulder harness was tight for take-off yet was found to be loose after the accident, so he may have been trying to reach the fuel valve which was reportedly difficult to turn.

An accident like this is very sad. We have repeatedly given the advice "FLY THE AIRPLANE", and this accident brings it home very forcefully. No matter what happens, if you run out of fuel on one tank or you have to shut it down for one reason or another, "FLY THE AIRPLANE". This must be your first priority. It cannot fly itself, you must maintain control, you must maintain airspeed. Then, and only then, switch tanks or do whatever else you may have to do, all the while maintaining control of the airplane.

Check your fuel valves for ease of operation. If yours is stiff, dismantle it, lap it in with jewellers rouge or a metal polish such as Brasso, using an electric drill. Clean it thoroughly and lubricate it with a suitable grease such as fuel lube, etc. Even if you have to do this once every 6 months or a year, do it, do not let your fuel valve get so tight that it becomes difficult to switch tanks.

While we are on the subject of fuel valves, be certain that you know where your valve handle should point when it is on the left and when it is on the right tank. Check carefully that the valve is in the detent and that this is, indeed, the tank you had selected. Clearly mark the position the handle is in when it is switched to the RIGHT, to the LEFT, as well as to the OFF position. It may be possible to select a mid-position between both tanks. This would not be good since, if one tank was empty, the fuel pump would pump air from the empty tank causing the engine to quit. Know your fuel system. Maintain your fuel valve regularly. Calibrate your fuel sight gauges so that you know exactly how much fuel you have on board. If, in spite of all of your care and diligence, something goes wrong, FLY THE AIRPLANE, try to correct the problem, pick a landing site, and execute a normal landing. Don't try anything fancy. A normal landing, maintaining flying speed and control to touchdown is always your best bet.

ACCIDENT
A Southern California Long-EZ was involved in a forced landing resulting in considerable damage to the plane although the pilot suffered only minor cuts and bruises. The cause of this accident was the use of a molded plastic prop that came apart a few minutes after

take-off. This resulted in a forced landing where there was no airport.

This is silly, People. Long-EZs and VariEzes are not good airplanes to test new-fangled props or engines. With a stall speed close to 60 knots, your chances of making a successful forced landing when (NOT IF), when, the plastic prop breaks or the engine quits (because it will, make no mistake about it) are very, very low. If you are into testing new plastic props or constant or variable speed props or auto engines, please, please, do all homebuilders a favor, and do yourself a favor (you may even save your life), use a Piper Cub or at least a factory built Cessna 150 or something with low wing loading that gives the best chance of making a successful off-field landing when you have your failures. At least, then this will not result in a blot on the record of homebuilt accidents but rather, will go down against factory built airplane accidents or incident statistics.

All of us who build and fly homebuilts must have in mind at all times that it is us, all of us as a group, who have the responsibility of policing our own actions and making sure that we do not end up as ammunition for those who are against us and who use every incident against us to shut us down and prevent us from flying and enjoying our creations.

We are not against experimenting, on the contrary, that is the business we are in and we encourage it. However, an experiment such as the above accident was virtually guaranteed to end in failure from the beginning and it should not have been conducted on an airplane as poorly suited for this type of experiment as a Long-EZ.

SHOPPING FOR A PROP?

B & T PROPS
Bruce and Bonnie Tifft
3850 Sherrod Road
Mariposa, CA 95338
209-742-6743

Bruce builds custom wood props with a urethane leading edge for VariEzes, Long-EZs and Defiants.

GREAT AMERICAN PROP CO.
1180 Pike Lane #5
Oceano, CA 93445
805-481-9054

Fred Griffiths' company cuts wood props for EZs, Defiants, etc. An option is a urethane leading edge or Kevlar wrapped blades.

TED'S CUSTOM PROPS
9917 Airport Way
Snohomish, WA 98290
206-568-6792

Ted Hendrickson is one of the earliest suppliers of EZ props and makes excellent wood props with a urethane leading edge for rain erosion protection.

The above three prop manufacturers are the only prop builders that RAF recommends.

SHOPPING
AIRLINER WINDOW KIT
"At Burt's Homebuilder Forum during Oshkosh '87, the green light was given for Plexiglass windows in the baggage strake floors. Several builders had made this modification to provide better ground visibility for backseat navigators who don't enjoy 90 banks to identify a checkpoint. Any size or shape is O.K., as Burt relates there isn't any structural member there.

One of Arnie's Army from Iowa but me on the trail of the Micro Mesh company as a possible source for inexpensive Plexiglass windows. I spoke to the President of Micro Mesh and learned that the lion's share of their companies profits don't come from selling their famous scratch removal kits, but rather from contract work restoring airliner windows. After about 6 years of high altitude exposure to UV light, the windows develop thousands of fine scratches known as "crazing". The windows are as much as $600.00 new, but Micro Mesh polishes them to crystal clarity for $100.00 each. The good news for us is that about 30% of the windows are rejected as too thin or they contain a small chip at the outer edge from a ham handed mechanic during removal. The $600.00 rejected windows are tossed in the dumpster!

They have recently sent me, (UPS collect), 50 rejected airliner windows for distribution to EZ'ers. The windows are about 11x15x1/4 inches, and of course vary from model to model, (it's fun just going through the boxes as most are labeled L1011, DC8, etc.). The Micro Mesh kit would be required to polish them out, (I did one in front of the T.V. in about 2 hours. The chipped windows all have some degree of crazing that would likely be unnoticeable under the wing, but knowing you guys, you'll want to polish these out also.

I am offering a FAA 51 percent approved kit containing everything you'll need except engine, prop, avionics, paint and airframe. No moving parts! Price is $599.95, (such a deal for you because I like you), unless you are a member of an EZ club or support group, (such as I.V.C.H.C., Squadron I (or II), Central States), in which case price is the UPS cost. I don't know where you live so send me $5.00 and I'll mail the change to you with the windows.

Buzz Talbot
222 Sunshine
Bolingbrook, IL 60439
312-759-1124

FOR SALE

Mooney nose gear for Defiant - $500.00.
Contact: Byrdell Mathews
26311 Hwy 75
Spring, TX 77580

work - 713-523-1751
home - 713-367-5071

Defiant Builders - two Cleveland 600x6 mag wheels and brakes with new chrome discs. Two B.F. Goodrich 600x6 6 ply, like-new tires and tubes plus two master cylinders, two axles and four rudder pedals with toe brake assembly. All for $500.00.
Contact: Jim Alexander
2950 Hwy 28 N
Boyce, LA 71409
318-793-4245

Bruce Tifft has a like-new 4" long prop extension available for use on a 180 HP VariViggen. Contact Bruce at:
B & T Props
3850 Sherrod Road
Mariposa, CA 95338
209-742-6743

FOR SALE! All items at 1/2 catalog price!

Two cleveland brake master cylinders (10-25). Two gas caps (416-5c assemblies, mil-c-7244B). O-235 cowling with P-51 type scoop. O-235 Flywheel without starter ring gear. O-235 flywheel with starter ring gear.
Contact: Chuck Abbey
Box 452
Dripping Springs, TX 78620
512-858-7818

Smoke Canopy for Long-EZ - $150.00
Contact: Dave Lund
15114 Paso Del Sol
Del Mar, CA 92014
619-755-6117

Cont. O-200A - 660 TSMO with accessories - $3500.00. without accessories - $3000.00.
Contact: Jim Alexander
2950 Hwy 28 N
Boyce, LA 71409
318-793-4245

WANTED

VariEze wing attach fittings, complete, for new construction.
Contact: Doug Whitt
3613 S. 116th E. Ave.
Tulsa, OK 74146
918-663-1704

SWAP OR TRADE

I have the following 12 volt parts and would like to trade them for equivalent 24 volt parts for a Lycoming.
12 volt starter, Prestolite part #MZ4204.
12 volt alternator, Prestolite part #ALE6406.

12 volt voltage regulator, part #USF7303.

All of the above parts have 1463 hours total time since new. My starter ring gear has 122 teeth.

Contact: Ray Ratzlaff
c/o Rutan Aircraft Factory, Inc.
Building 13 - Airport
Mojave, California 93501
Call 805-824-2645 (Tuesdays and Fridays)

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.
OBS	Obsoleted by a later change.
MEO	Minor error or omission.

PLANS CHANGES

VARIEZE

MAN-GRD Check wing attach fittings for corrosion. Remove both wings, clean and inspect the wing attach fittings on the wings and on the centersection spar. See this CP for a more detailed description.

VARIEZE, LONG-EZ AND DEFIANT

DES Static ground for potential fire problems. See this CP for details.

NO SOLITAIRE CHANGES

BUILDER HINTS

Defiant - Several builders have reported difficulty in installing the Defiant main gear between the F.S. 145 and F.S. 153 bulkheads due to the gear attach tabs building up the width of the gear. Before laying up the attach tabs, grind the trailing edge of the gear forward locally at each attach tab area about 1/4". Then layup the attach tabs and it will fit between these two bulkheads perfectly.

Defiant - Optional low level float switches for the fuel tanks, as used in Burt's Defiant are supposed to float in AVgas. They used to! We have used them many times on various airplanes over the years with excellent results. Recently, we installed brand new float switches in the Catbird fuel tanks and, much to our chagrin, they sank and were useless.

We removed them, checked them in water, they floated, but they would not float in fuel!! We called the company that makes them and were told, "yes, that is correct, they are made not to float in gasoline"! Something to do with liability insurance. Anyway, - what to do? We simply carved a foam ball out of H-45 PVC foam (Divinycell), drilled a hole in the ball, and floxed it on to the end of the float. The ball is a little smaller than a golf ball. We painted the ball of

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foam with a light coat of epoxy to seal it and protect it. It floats great in fuel, and PVC foam is impervious to fuel so it should last indefinitely. While these are not specifically called out in the Defiant plans, we strongly recommend them to be installed one in each sump tank.

BUILDER HINTS

All RAF designs - While waiting on cure cycles or parts to arrive, or while you are delayed for whatever reason, do little bits of finishing work on the parts you have done. Keep a one gallon kit of West System Epoxy handy. This is obtainable from Gougeon Brothers, PO Box X908, 706 Martin Street, Bay City, Michigan, 48706. Call 517-684-7286 or 6881 (orders only). Ask for 105-B resin, 205-B hardener (fast) and a 301-B mini mump set to pump the correct ratio out of a one gallon resin can and a one quart hardener can. They also sell a slow hardner 206-B but we believe the fast, 205-B, is more useful for mixing dry micro. (You will probably use about 2 gallon on a Long-EZ.)

We mix it as follows: One stroke of each pump into an 8 ounce paper cup, mix thoroughly. Add one heaped 3 ounce paper cup of micro balloons and stir thoroughly. Spread this mix of dry micro and West onto your wings or winglets, canard or whatever you have done, particularly in any low spots like next to a spar cap, etc. Trowel it on a bit thicker than you need and allow it to cure. A full cure normally takes less than 12 hours depending on the ambient temperature. Here in the desert, we can spread it on in the morning and sand it to contour in the afternoon. It is a good idea to dampen a handful of

paper towels with West epoxy and moisten the part prior to troweling on the micro. Of course, the bare glass should be scuff-sanded with 36 or 40 grit sandpaper prior to wetting with West epoxy. Don't get it too wet, just moist for a good bond. The West system epoxy and micro will bond very well to Safe-T-Poxy and will be easy to sand (unlike Safe-T-Poxy and micro!!).

Doing a little finishing all the while as you are building will make the finishing process at the end of your project a lot easier to stomach! After all the parts are built, the engine and wiring and systems are all in and done, it is usually quite demoralizing to suddenly find yourself faced with the enormous task of sanding, filling, contouring, sanding, filling and sanding and painting all at once. A little filling done once or twice a week will leave you with a much smaller job at the end of the project. Try it, you will be glad you did!

MAGNETOS - TIMING-REMOVAL AND REPLACEMENT

Our experience here at RAF is confined almost exclusively to the Slick magnetos due to Slicks being easier to fit in the confines of an EZ, also due to their being lighter in weight. Since most EZ flyers will have Slicks installed, this discussion will concern only the Slick magneto.

We will start out with the installation of the magneto since this may be the most confusing area, leading to the most starting problems, etc. based on the calls and letters we receive. The older style, 4050 and 4051, "throw away" models probably should be traded in on the newer 4250 and 4251 rebuildable mags. They are more reliable, more readily obtainable, and are easily repaired or rebuilt even by the owner/builder. Basically the differences between the original "throw away" and rebuildable mags is size. The "throw away" being smaller than the rebuildable. Also, when timing the magneto, prior to installing on the engine, you must "spark out" the "throw away" model by spinning the timing gear to set the magneto on cylinder number one. On the newer, rebuildable magneto's, Slick supplies a little "pin", a T-118 timing pin, which is used to set the magneto timing to the number one cylinder. With the distributor cover off, look into the forward end (on a EZ!) of the mag, you will see two holes in the plastic molding, the top one marked for left hand rotation (L), the bottom on for right hand rotation (R). Look on the data plate on the body of the mag for its direction of rotation. Left rotation is normal for a Lycoming O-235, O-320, or O-360. Now, gently push the timing pin into the hold marked (L) until it bottoms. Rotate the timing gear on the shaft of the mag opposite the direction of normal rotation until you feel the pin drop into a hole.

If you have to rotate the magneto very far, you will feel the timing pin trip over a bump inside the mag. Don't force it to rotate. Gently back the timing pin out a 1/4" or so to clear the bump, rotate the shaft and gently push the pin back in. Continue rotating until the pin locates in the hole. The magneto is now internally set on cylinder number one. It is not a bad idea to tape the pin in place with a piece of masking tape. In any case, the pin must remain in this position, without the distributor cover installed, until the magneto is actually in place on the accessory case.

Now, you must set your engine at 25 degrees before top dead center on the number one cylinder (or whatever angle your data plate calls out, 28 degrees for O-235-L2C). Remove the top spark plug from the number one cylinder, hold your thumb over the hole and rotate the engine in the direction of normal rotation until you feel pressure under your thumb. Continue rotating the crankshaft until the advance timing mark (20, 25, or 28 degrees, check your data plate) is exactly opposite the small hole located at the 2 o'clock position on the front face of the starter housing. (This is for Lycoming engines with a starter and starter ring gear installed.)

NOTE: If the prop is accidentally turned in the direction opposite normal rotation, you must repeat the above procedure since accumulated backlash in the timing gears will make the final timing incorrect.

At this point, the engine is ready for assembly of the magneto's. With the timing pin still in place, carefully fit the magneto into its hole. When it sits flush on the machined surface of the accessory case, pull the timing pin out (rotating the prop at this point may shear the timing pin off) and, while holding the mag firmly in place, install the toe clamps, flat washers, lock washers and nuts and tighten until finger tight. Repeat for the other magneto, being certain that the prop has not moved.

Use a battery powered magneto timing light such as a model E50 from Eastern Electronics (available from Spruce). Connect it to a convenient engine case bolt (ground) and to each magneto terminal (the same stud your mag switch is connected to). If the mag switches are wired up, you will have to make both mags "hot" (mag switches to the normal engine running position even though the distributor cover is not yet installed). Make sure the fuel valve is off and the mixture is at idle cut off, and always treat the prop as you would a loaded gun!)

Rotate each magneto in its housing until the timing light comes on. Now slowly turn it in the opposite direction until the light goes out. Slowly turn the magnetos forward again until the timing light just goes on. Tighten the nuts a little.

Now, back the prop off enough to turn both timing lights off. Slowly bring the prop back in the direction of normal rotation until both lights come on. They should come on simultaneously, or very close to it. Now check and see if the appropriate timing mark on the starter ring gear is in perfect alignment with the hole in the starter housing. If it is, tighten the magneto hold-down nuts firmly (maximum torque is 150 inch/lbs., minimum is 110 inch/lbs.). Recheck that the timing lights come on together at the proper time and you are ready to install the distributor caps. If you are working on a Long-EZ, this is the hard part! The distributor covers are so close to the firewall that a 90 degree screwdriver must be used on the standard Slick screws. Believe it or not, this can take an hour or more to do! The Allen head screws Mike called out in CP 54 make this job easy (less than 30 seconds per screw) and he still has a supply of stainless steel Allen head screws suitable for this job. Send $1.00 plus a SASE for 6 screws.

There you have it! If your airplane has a Lycoming engine and no starter or starter ring gear installed, you will need a timing indicator such as model E25 and a top dead center locator (both available from Aircraft Spruce) or an equivalent protractor-type indicator.

This type indicator fits onto the spinner or prop (does not need to be centered) and has a weighted pendulum-type pointer. Use the top dead center finder in the top spark plug hole on cylinder number one, set the protractor indicator so the pointer points at 0 degrees or top dead center (TDC), then turn the prop backwards to about 35 degrees before TDC, then come slowly forward to 25 degrees (or 28 degrees) to be certain to get rid of all backlash.

If you have a Continental engine with Slick mags (O-200 VariEze), the main difference is that the crankshaft flange on Continental engine is marked every 2 degrees from 24 degrees to 32 degrees. You must look on your data plate to determine which to use (O-200 is 28 degrees BTDC). There is also a mark for TDC. It is a line across the edge of the prop flange between the letters TC.

You will need to make a triangular aluminum pointer on which you must scribble an index line that is perpendicular to the base and passes through the apex. The base of this metal pointer should be placed on the machined front surface of the crankcase with the index line exactly on the split in the crankcase halves. Rotate the prop in the normal direction of rotation until the index line points at the 28 degree mark (O-200A). This sets the engine with the number one cylinder at 28 degrees before top dead center which is the point at which you install the Slick magneto (which is also timed to the number one cylinder) per the instruction for the Lycoming.

If you have an older 4051 Slick mag that needs to be "sparked out", remove the bottom vent plug. The distributor cover must be installed and you must find the high tension lead marked T1 or B1 on the spark plug nut. Hold the lead wire spring 1/16" to 1/8" away from the magneto body and turn the impulse coupling one "click" at a time until you see a strong spark jump between the spring and the magneto body. Stop turning the shaft right at the point where the impulse trips and the spark occurs. You may have to do this several times to get it correct. It will not shock you if you do it right!

Now, reverse the rotation about 25 degrees until you can see the timing pin hole through the vent plug hole. Insert the timing pin which will hold the rotor and line the pin up with the center of the vent plug hole. Now install the magneto onto the accessory case.

On a 4050 Slick mag with no impulse, you must turn the shaft vigorously counterclockwise (LH rotation) until a strong spark snaps from the spring to the magneto body.

WHEEL ALIGNMENT

When you built your EZ or your Defiant, you should have set the axles on the main gear such that your main wheels were toed in about 1/4 degree on each side. If you have noticed excessive tire wear, inside edges or outside edges, it is time for you to check and possibly adjust the main gear alignment. With an already completed airplane, probably the easiest method of checking this is as follows: Load the airplane to the same load that you normally fly. Now, pull the airplane at least 100 feet forward on a smooth concrete or blacktop surface. This will allow the gear to spread to its normal position, the wheels will be in their natural position for this weight, and this is the condition you want to check the wheel alignment. Using a plumb bob or level, drop the aircraft centerline to the ground (center of the nose, center of the spinner tip), snap a chalk line between these two points. Use a 36" straight edge (hardware store, aluminum yardstick) and hold it so that the center of the 18" mark is at the axle centerline. Hold the straight edge against the wheel rim (or tire if fat tires are used!) and measure from each end of the 36" straight edge to the chalk line aircraft centerline. Record these dimensions and repeat on the opposite wheel. Ideal or perfect results would have A=A2, B=B2 and A+A2 = B+B2 or slightly less. **SKETCH OMITTED**

When A+A2 = B+B2, then the main gear toe-in is zero which is probably the perfect situation for tire wear, but 1/4 degree of toe-in, that is A, would be approximately .080 smaller than B and A2 would be approximately .080 smaller than B2, would be best for ground handling and straight tracking. Measuring to the airplane's centerline lets you know if you have the gear on straight but, realistically, it is not critical of your A and B dimensions are not identical to your A2 and B2 dimension. Wow, hopefully you are not all too confused by the above!

Remove your axles and use metal taper shims (available from Aircraft Spruce or Wicks) or build up the gear leg with glass and grind to set your axles to meet the above dimensions (you also must use 36" straight edges or the dimensions will be different for the same angle!). Once you have the correct toe-in set, you will notice an improvement in tracking, shorter take-off and less tire wear! Go for it!

HOW TO CHECK FOR THE CORRECT PROP

With any of the RAF designs, matching a perfect prop to your new plane is not real easy but it is not all that difficult, either. The main problem is that the stall speed and the maximum cruise speed in level flight are quite far apart, and getting a fixed pitch prop to cover the whole range perfectly, is not possible. You have to accept a compromise.

With the engine thoroughly warmed up, park on a clean piece of hard surface in the runup area, lock the brakes, and smoothly go to full throttle. If you are at a high density airport, you will have to lean slightly to get maximum static RPM. If you do not see at least 2350 RPM, your prop is already suspect! 2400 RPM is better and 2500 RPM is not unacceptable. Of course, all of this assumes you have an accurate, easily read tack without which this test cannot be conducted. Now, taxi out and make a normal full throttle take-off. Observe the RPM during this take-off roll (make sure you watch where you are going, use only an occasional glance at the tach). The RPM during the roll and

early part of the climb should be the same, or actually increase slightly. Maybe 100 or so RPM above static.

Use a normal climb speed, best rate or even a little higher for good engine cooling and better visibility. The RPM should hold at your static or a little better all the way to 8500 feet MSL. As a rule of thumb, your normally aspirated aircraft engine will develop approximately 75 percent power at 8500 feet at full throttle, mixture leaned to peak RPM.

At full throttle, leaned to best power, concentrate on maintaining exactly level flight at 8500 feet (altimeter set at 29.92), fly for several minutes in this condition to allow the airplane to accelerate to its maximum speed. When you are certain it won't go any faster in level flight, read the indicated airspeed and OAT (just for your own reference, since this is your maximum 75 percent cruise speed and you can figure your true airspeed if you know the airspeed calibration error and instrument error). The RPM at this point should be 50 to 100 RPM over the factory recommended maximum RPM. If it is not, you will probably never realize the full take-off and climb potential of your airplane. Now, obviously, most people would not want to fly at over the factory red line, and that is good, you don't have to. This is just a test to see if you have as close to an optimum prop as possible. If your prop meets the above RPM limits, you have the best possible prop for all around performance, good take-off and climb and good high speed performance.

You must now decide if you want to sacrifice maximum speed and shortest take-off and climb performance for something more of a cruise prop, say 2300 RPM static and 2700 RPM at full power at 8500 feet. This will let you cruise at a reasonable speed, good economy and a fairly quiet cockpit but you will give up take-off and top speed performance. On the other hand, a 2500 RPM static and 2900 or even 3000 RPM flat-out at 8500 feet will give you excellent take-off and climb and a very high top speed - it all depend on what you want! You can not have everything with a fixed pitch wood prop but at least you do get a reliable, safe, economical, easy to maintain prop.

You must do this test at 8500 feet because 75 percent power is the reference point for maximum cruise speed on all light planes and because this is the easiest way for you to know you are putting out 75 percent power. Doing all of this at 3000 feet or 5000 feet really does not tell you anything at all unless that is where you always intend to fly.

Keep in mind that this is a quick and easy rule of thumb type method that will work well for most homebuilders. It is not the absolute epitome in accurate testing methods but it does give surprisingly close results.

One other comment: We have seen some props that only turn up 2100 RPM static and 3000 or 3100 RPM at Vh (maximum speed in level flight). The performance results with these props, in our opinion, are not acceptable and the designers of these props need to go back to basics

and learn how to really design a good wood prop, such as the three prop manufacturers we have listed in this CP, produce.

FULL THROTTLE HP AT ALTITUDE
(Normally Aspirated Engines)

Altitude Ft.	%S.L. H.P.	Altitude Ft.	%S.L. H.P.
0	100	10,000	70.8
500	98.5	11,000	68.3
1,000	96.8	12,000	65.8
2,000	93.6	13,000	63.4
2,500	92.0	14,000	61.0
3,000	90.5	15,000	58.7
4,000	87.5	16,000	56.5
5,000	84.6	17,000	54.3
6,000	81.7	17,500	53.1
7,000	78.9	18,000	52.1
8,000	76.2	18,500	51.4
9,000	73.5	19,000	50.0

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

VariEze wing attach fitting WA-2-2 removed from a Harlingen, TX based VariEze. Note extensive flaking typical of severe intergranular corrosion.

Ivan Shaw's Twin-Eze, a modified VariEze/Long-EZ retractable twin.

Randy Pflanzer's excellent instrument panel layout.

Harry Bawcom's outstanding instrument panel - very clean, well thought out layout.

Slick 4250 magneto - note timing pin in top hole for left hand rotation.

Bruno and Nathalie Guimbal's newest "homebuilt", Olivier. Nathalie carried this little guy (before he was born) all over the States and at Oshkosh when the Guimbal's visited this country from France in their VariEze, F-PYHZ.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Burt's 62 percent scale model of the Advance Technology Tactical Transport (ATTT). Built by Scaled Composites and flown by test pilot, Fitz Fulton, retired from NASA where his duties included flying the 747 with the Space Shuttle on its back.

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THE CANARD PUSHER NO 56 July 88

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 56.
VariViggen (2nd Edition), newsletter 18 to 56.
VariEze (1st Edition), newsletters 10 thru 56.
VariEze (2nd Edition), newsletters 16 thru 56.
Long-EZ, newsletters 24 through 56.
Solitaire, newsletters 37 through 56.
Defiant, newsletters 41 through 56.

A current subscription for future issues is mandatory for builders, as this the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am to 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please have your serial number ready. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send a stamped, self addressed envelope if you have builder's questions to be answered. If you are placing an order, it's best to keep it separate from a request for an answer.

(This issue was produced on a new computer system with slightly different formats. Please give us your comments on how to improve it.)

RAF ACTIVITIES

The Catbird has taken all of our energies since CP 55. We have been working hard, flight testing, measuring performance and preparing the airplane for the CAFE 400 and for the Jackpot Air Races. We are also getting her ready for the trip to and from Oshkosh. Burt is planning on flying the Catbird non-stop to Oshkosh 1988 where it will be on display on the flight line. We are currently installing an S-TEX two-axis autopilot and we will have it connected such that it will track the Northstar loran or the VOR. It will also hold altitude.

See in this CP for more information on the Catbird and its successes in the races.

BURT'S OSHKOSH SCHEDULE FOR 1988

Saturday, July 30th	Rutan Design Forum 2:30pm - Tent 3
Sunday, July 31st	Design College 8:30am - Tent 3
Sunday, July 31st	Pond Racer Forum 1:00pm - Tent 4

(This is a change. The Sport Aviation program will show INCORRECTLY 10:00am in Tent 3)

SCALED COMPOSITES ACTIVITIES

July 12, 1988 was the date of the first flight of Burt's latest design, a small biz-jet with two Williams jet engines mounted on top of the wing roots. Fitz Fulton, ex-NASA test pilot who now works at SCALED, was at the controls. Mike Melvill chased the mini-jet in his Long-EZ and this flight was extremely successful - and it was significant in that this was a first flight for the Williams engines, as well as a first flight for a new aircraft design.

Burt has decided to have the AT3, or Advanced Technology Turboprop Transport, at Oshkosh 1988. Fitz Fulton will fly it to and from Oshkosh where it will be on display from Friday through Sunday.

SCALED has also completed and delivered a "hard" sail for the America's Cup Catamaran sailboat which, hopefully, will compete with the New Zealand sailboat for the America's Cup sometime before the end of this year. The "sail" is really a carbon fiber wing, standing

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on end and cable braced into position on the catamaran. The "wing" is 95 feet tall and has movable trailing edge control surfaces. So far, Dennis Conners who will be sailing it in the contest, is pleased with the speed and maneuverability. This catamaran has received much publicity in the press. Next time you see it, look closely at the "sail", it is a beautiful, graceful aircraft-like wing.

DEFIANT FIRST FLIGHT IN AUSTRALIA

Clive Canning writes that on May 14, 1988 he flew his new Defiant VH-001 on its initial test flight from North Brisbane's Redcliffe airport.

He has now completed the Department of Aviation required flight test program (a 22 page document!), part of which had to be written for him since his Defiant was the first multi-engine aircraft (other than factory built) to be certified in Australia. Congratulations, Clive, welcome to the ranks of RAF design flyers.

Clive Canning is the builder of a Thorp T-18 which he flew from Australia to England some years ago, and then wrote a book about his trip - and what a trip it was! He was shot at by MIG's in Syria, and ended up in prison there. Charlie Mike Charlie, an excellent book, is must reading for anyone interested in flying and, especially interested in flying homebuilts.

BURT'S BIRTHDAY PARTY FLYIN

Saturday, June 18, 1988 dawned bright and clear at Mojave. Already a few EZ's were parked on the ramp in front of RAF. Dick Kreidel and a few helpers set up a spot landing line on runway 7 and started measuring to see who landed closest to the line. David Orr did most of the organization for this flyin, including mailing cards out to everyone. We sure appreciate Dave's efforts.

For the first time, David was able to fly in to one of the flyins he has organized for years in his own recently completed Long-EZ - Good for you, Dave.

By noon, there were over 80 RAF designs on the ramp and, since most people flying in brought a dish of something to eat, there was a tremendous supply of food on the tables in the RAF hangar. Burt was in great spirits and spent several hours out on the ramp with his new Catbird, expounding on the virtues of such neat things as forward swept "T" tails, centerline pilot seats, turbochargers, pressurization, etc., etc.. One of the major highlights of the day was when Burt conducted a tour of those parts of the SCALED Composites building that did not have proprietary projects in them. Virtually everyone who flew in managed to get in on this tour and it was greatly enjoyed by all.

By the end of a really super day, a total of 93 RAF designs had been counted on the ramp here at Mojave. Not even at Oshkosh can that many be seen at one time. The "event" has been traditionally held every two years here at Mojave and the consensus was - "let's do it again in 1990!"

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"IS HE GOOD, OR WHAT?" DEPARTMENT

Alan Dierksen, in his Long-EZ, N974EZ, came closest to the line in the landing contest at the birthday party. Congratulations, Alan, you have won a year's subscription to the CP for fine flying!
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CAFE 400 - 1988

Burt had predicted several years ago when he designed the "CATBIRD" that it would win the CAFE 400 efficiency race. This prediction came true on June 25, 1988 when his CATBIRD won overall, setting a new record high score, winning its category - Experimental, three or more seats - winning "Best New Design Award" which was a brand new Northstar M1 Loran. Also the Tom Jewett Memorial Award (best MPG x Payload) and for the pilot, Mike Melvill, winning the coveted LoPresti Award.

The Catbird carried five people on board for the race and was loaded with 63 gallons of fuel to bring her payload up to 1000 lbs. She

lifted off in about 1500 feet, well within the 2000 feet criteria and, thanks to the Northstar loran, flew the course accurately until the last turn point. At this point, we were home free, right? Wrong! We could see the airport, so without setting the loran, we headed for it. Burt and Mike recognized at the same instant that this as the wrong airport! Punch in the loran and head for the correct airport. This error cost us only a few miles and perhaps 30 seconds but it certainly got our attention!

We flew over the final check point, the Santa Rosa air center which is where they stop the clock, and entered downwind, got the gear down, landed quite short and taxied to the weight scales. We knew from our Alcor fuel-flow indicator what we had burned, but we wanted it verified on their scales. We were most satisfied when the weighing showed we had used within 1-1/2 lbs, or 1/4 gallon of our indicated fuel flow! We knew our race time, so we now knew our CAFE score. We were sure we had won, but it was really exciting at the Banquet and Awards ceremony to be called up and presented with all of the awards we did get. The crew of five shared the prize money and all of us had a really fine weekend in Santa Rosa.

Gary Hertzler, in his now "almost legendary", 80 HP VariEze, won the experimental two place as well as the CAFE Award for the largest percentage of gain in fuel efficiency in a category. Gene Sheehan was second in his quick 100 HP Q-200, followed by Klaus Savier in his very fast 100 HP VariEze. These three competitors have been dicing with each other each year for several years now and, this year, their scores were within 3 percent of each other. Close competition, incredibly efficient airplanes, good company, and lots of fun. Here are the results of this year's CAFE 400.

A/C	PILOT SPEED	PAYLOAD(lb) MPG CAFESCORE	SEATS HP
CATBIRD	MELVILL 192.3	1000 21.6 2751708	5 210
VARIEZE	HERTZLER 152.5	400 49.25 2360859	2 80
Q-200	SHEEHAN 174.6	400 40.93 2322493	2 100
VARIEZE	SAVIER 177.0	400 39.57 2284493	2 100
SUPER BD	WARD 173.1	800 18.58 1754892	4 300

LANCAIR	MAXWELL	400	2
	188.8	27.72	125
		1734679	
GLASAIR	KEEFE	400	2
	209.0	22.24	180
		1580555	
MOONEY	HAWKINS	799	4
	151.5	19.62	200
		1566710	
MOONEY	HUDSON	798	4
	167.2	16.65	200
		1503079	
MOONEY	LOEWEN	703	4
	163.6	18.62	200
		1487699	

JACKPOT 1988

Burt flew Catbird, Dick flew "old blue", his record setting Long-EZ, and Mike and Sally flew up in N26MS, their own Long-EZ. On the way up, Burt spent most of the trip gathering altitude performance data for the Catbird and it was a beautiful flight at 17500 feet, absolutely smooth, with a good tailwind. When we arrived at Jackpot on the morning of Saturday, July 2nd, there were already over 50 EZ's on the ramp! The afternoon was spent in the pool. The evening dinner show was fun, but the big event was early Sunday morning - "Jackpot races".

Four separate classes raced: Stock VariEze, Stock Long-EZ, "Super Stock" (Long-EZ's modified), and the Unlimited EZ (all EZ's not built per plans).

Burt flew the Catbird in the same race as the unlimited EZ's under Exhibition class. The first race was Stock VariEze's and it was won by Shirl Dickey. He beat Gary Hertzler by less then 2 miles per hour! The neat thing about it was that Shirl and Diane Dickey originated the Jackpot and Wendover "EZ" flyins because Shirl has always been a competitive racer in everything he has been involved in from speedboats to airplanes. In five Jackpot flyins, Shirl had never won until this year. Congratulations, Shirl!

The second race was Stock Long-EZ's won by Bob Brown in his beautiful Long which he just recently flew his time off.

The third race for the modified Long-EZ's (bigger engines), the Super Stock Long-EZ class was won by Ed Kelly in his amazingly fast Long-EZ. Ed was very fast at the Sun 60 Air Race at Sun-N'-Fun earlier this year, turning a lap from standing start at over 215 MPH! Second was Dick Kreidel and, interestingly, the third and fourth place finishers were two Cozy's, Vance Atkinson (a

previous VariEze builder) and Ken Francis.

The last race was for Unlimited EZ'S which included highly modified (bigger engines, as well as airframe mods) VariEze's and Long-EZ's. The Catbird flew in this race under the Exhibition class and Burt proceeded to completely annihilate the course record, set by Mike Melvill last year at 225,98, with a blistering speed of 245.54 MPH! That "Cat" is fast! Mike Melvill won this race, with John Chambers in his highly modified O-235 powered VariEze second. Ed Kelly came in third and Wes Gardner in his Lycoming powered VariEze was fourth.

This was the best Jackpot ever. The weather was perfect, 78 RAF and composite-types flew in to enjoy the hospitality of Cactus Pete's Casino, and a great time was had by all. Two Long-EZ's flew in from New York, a VariEze flew in from Wisconsin and a Cozy flew in from Texas! There were 44 Long-EZ's, 29 VariEze's, 1 Defiant, 1 Catbird, 2 Cozy's, 1 Two Easy. In addition, a Tailwind and 3 Spam Cans flew in. We had over 150 people at Cactus Pete's over the 4th of July weekend and it was great. Many, many thanks, once again, to the organizers of this great little flyin, Shirl and Diane Dickey - you guys done good !!

RACE RESULTS

STOCK VE			(MPH)
	1ST	SHIRL DICKEY	199.31
	2ND	GARY HERTZLER	197.17
	3RD	JOE MOORE	196.88
	4TH	BOB PAULSON	189.0
STOCK LEZ			
	1ST	BOB BROWN	188.99
	2ND	TOM JEWETT	187.98
	3RD	BOB CAMPBELL	184.56
	4TH	DOUG KIRKPATRICK	183.98
SUPER STOCK			
	1ST	ED KELLY	216.04
	2ND	DICK KREIDEL	215.65
	3RD	VANCE ATKINSON(CO-Z)	208.67
	4TH	KEN FRANCIS (CO-Z)	205.98
UNLIMITED			
	1ST	MIKE MELVILL LEZ	228.89
	2ND	JOHN CHAMBERS VE	218.21
	3RD	ED KELLY LEZ	216.07
	4TH	WES GARDNER VE	209.26
EXHIBITION			
	BURT RUTAN CATBIRD		245.54 MPH
	(NEW COURSE RECORD)		

SHOPPING

Bob Davenport's nose gear shimmy damper for VariEze and Long-EZ...

This is a very important addition to your EZ. The original plans-built shimmy damper required constant care and adjusting, and in many cases, still allowed the nose wheel to shimmy and break the nose wheel fork. This has happened to a lot of EZ flyers. Don't let it happen to you. Contact:

Bob Davenport
PO Box 650581
Vero Beach, FL 32965-0581
305-567-1844

Valve Cover Gaskets for Lycomings and Continentals.

Made from 100 percent pure silicone, these gaskets will absolutely solve the age old problem of oil leaks at the rocker cover to cylinder head gasket area, especially on Lycomings! Contact:

Doug Price
Real Gasket Corp.
PO Box 1366
Laurel, MS 39441-1366
800-635-REAL or 601-649-0702

Doug has recently come out with a silicone gasket for the small Continental engines to fit between the oil tank and the bottom of the crank case. He is very happy with its performance.

Oil Breather Systems and Retrofittable Fuel Sight Gages for EZs.
Contact: Wes Gardner
1310 Garden St.
Redlands, CA 92363
714-792-1565

B&C SPECIALTY PRODUCTS suppliers of alternators & voltage regulators for the VOYAGER are pleased to announce that their light weight starters in 12 volt & 24 volt are now STC'd for all LYCOMING O-235, O-290, O-320, O-360, & O-540 engines. The sealed lead acid batteries they stock are also highly recommended.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
P.O. Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
P.O. Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

FOR SALE

Lycoming O-235-L2C, 2450TT, 95 since extensive top overhaul by Lycoming dealer, Hagelin of Long Beach. Includes all accessories, prop extension, prop and spinner. This engine won the stock Long-EZ race at Jackpot 1988. $5500.00. Contact:

Bob Brown
818-961-9871 (w)
714-525-8032 (h)

Breather System for Lycoming.

Mike has been using this system now for over 1000 hours and is very satisfied at this point. Wes Gardner has been running his for several years. He is the designer, builder and supplier of this rather unique system.

The breather hose goes from the engine to an optional (in Mike's opinion!) oil separator mounted on the firewall and drains back into the engine from there. The breather hose then goes to a "T" fitting and on to a one way check valve which is welded into the exhaust header. A smaller hose goes from the "T" through a PCV valve to a fitting in the intake manifold. It sounds complex but it really is not. You will have to have a stainless tube welded into one of your exhaust pipes and you may have to tap a 1/8" NPT pipe thread into the intake manifold, or Wes can supply you with a part that clamps between the carburetor and the sump to take care of the problem. Mike does not use the separator itself rather, he just accepts the loss of oil that goes out of the exhaust. It is so small in his case that you cannot tell which of the four exhausts it is draining into. Wes, on the other hand, is very happy with the separator and recommends it.

What does this system do? Well, it takes your breather and its associated messy oil stains on the cowling and dumps it through the exhaust system where all the oil vapors and oil are burned, and thrown out of the exhaust pipe, leaving no oil on the cowl. In addition, and perhaps more significantly, it lowers the pressure in the crankcase to below ambient pressure which causes any small oil leaks you may have to disappear due to the fact that these leaks now leak into, and not out of, the crankcase. Obviously, this slight reduction in internal pressure cannot take care of a major oil leak, but it is amazing how all the annoying little oil leaks dry up!

This is not a Lycoming recommended system, but it is a system that Wes has tested now for several years and one he has had running on several airplanes, including Mike and Sally's Long-EZ. Mike has not wanted to recommend this system in the past even though he has been running it for a number of years, but since Wes included the PCV valve in the system, the few little reservations Mike had have gone away. See "Shopping".

CAUTION

Do not substitute micro for flox where it calls out to use flox in the plans. Flox is an extremely strong structural-type filler and is quite heavy. If it is called out instead of micro, it is because we require the additional strength in spite of the small weight penalty. Where micro is called out as a filler, do not use flox since the strength requirement is not needed and you will only pick up unnecessary weight.

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory - ground the aircraft.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours, whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.

THERE ARE NO PLANS CHANGES FOR ANY RAF DESIGNS THIS TIME.

Please submit any significant plans changes that you may come across as you go through the building process.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need help from you.

ACCIDENTS AND INCIDENTS

Bob Yarmey, a professional pilot and Long-EZ builder, was involved in a serious accident in his Long-EZ. Recently he offered to share his thoughts with all of us and he wrote this accident report and comments. It is not often that any of us who fly get to hear the thoughts and opinions of a pilot involved in a serious crash for obvious reasons. Bob is a very experienced pilot and a very observant person whose views may be very important to all who fly. We found his comments on how to touch down in a short field in a emergency such as he had, most instructive and very perceptive. The average homebuilder/pilot is so concerned with damaging his creation that in a bad situation, instead of trying to preserve the safety of the people aboard, he or she is

likely to try to preserve the airplane at all costs. As Bob has pointed out, this is not the way to go. We can appreciate this point, particularly, having been there a time or two ourselves. Every EZ builder should read this accident report several times. The time may come when knowledge such as this could save your life. We are most grateful to Bob Yarmey for taking the time and having the courage to write this report so that others may benefit.

REQUIEM? FOR A LONG-EZ

With much excitement, I awoke on the morning of June 14, 1986. The previous night, I had been up late - washing and waxing my Long-EZ, N23RY. I wanted her to look her very best while on display at the big Texas Sesquicentennial Airshow in Waco, Texas. With my wife, Margi, settled in the back, we enjoyed a comfortable 45 minute flight from our home base at the Addison Airport in North Dallas.

It grew to be an oppressively hot day - right at 100 degrees. We enjoyed a great airshow, yet after having answered hundreds of spectator questions, we were anxious to get airborne once the field reopened. A little over half way back to Dallas at approximately 2500 feet AGL, we experienced a sudden complete loss of power. Searching around, I spotted a field about a mile off the right wing. As I swung into a wide right-hand turn to land into the wind, I turned on the boost pump, switched fuel tanks and checked the mixture and mags - all to no avail. Established on a base leg, I can recall observing a line of trees at the roll-out end of the field and utility lines at the approach end. Given what I estimated to be about 2,500 feed of field in between, I decided that my approach path should be planned to just clear the wires. I felt well prepared for this situation since I had performed a good number of practice forced landings and actual engine shut-downs both during my thorough flight test phase and subsequently. My 170 hours in this Long-EZ had been accumulated since her maiden flight four months previously. My overall experience includes 9,300 logged hours as a professional pilot in a wide variety of aircraft.

Once on final, Margi recalled me saying that I needed to go a little bit lower. I remember

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feeling confident on a short final that everything was going to turn out OK. Tragically, this was not the case as I was to realize while slowly emerging from heavy morphine sedation a week or so later.

I was disappointed with the FAA's investigation of the accident. Once the badly damaged forward fuel lines were by-passed and the prop replaced, the engine started up and ran satisfactorily. Despite the extensive damage at the fuel selector location, the FAA said the AN 818 aluminum coupling nuts were found to be finger tight and listed this as the probable cause. This was hard for me to accept as I had recently applied fuel lube to help unstick the fuel selector valve and had checked that these fittings were plenty snug. I personally suspect that given the hot conditions and my use of mogas that the occurrence of vapor lock was a possibility.

The accident investigation revealed that after impact with some smaller gage wires near the top of the cluster, the aircraft impacted the ground 70 degrees nose down at approximately 70 kts wings level. The fuselage shattered with severe damage extending to and including the front seat bulkhead. I was ejected at the impact point as the aircraft flipped over and came to rest 27 feet further on. Margi was terrified as she remained secured in the inverted aircraft with fuel coming out of the broken vent lines. Other damage included: a clean shearing off of the right winglet at the attach juncture, one-third of the top left winglet crushed (with no apparent damage at the juncture), the left-hand baggage pod sheared off in the wing saddle area although the right-hand pod remained attached intact, the canopy and aft turtle-deck were flattened to within approximately 4 inches of the longerons, the head rest sheared off along with a good portion of the front seat bulkhead, the canard remained surprisingly intact except for major crushing damage to the center section area.

We thank God that given the severity of the forward fuselage and canopy damage, that both Margi and myself came out of it alive and reasonably well. She suffered a concussion and a cracked rib. We were very fortunate that bystanders were immediately available to re-right the aircraft and extricate Margi. Also, a veterinarian was right on hand and administered three tourniquets to me. A Care-Flight helicopter delivered me to the emergency room in quick order. I don't know how, but I appeared to have maintained consciousness during the whole ordeal. Unfortunately, both my legs were eventually amputated just above the knees. I am thoroughly convinced that my decision to employ approximately 15 pounds of extra thickness thermo-foam absorbed a great deal of the impact forces and prevented both of us from receiving any internal or spinal injuries. In reflecting on how this tragedy might have been avoided, I would advise against the use of any automotive fuel. Although I had no problems in using it up to that day, operating temperatures had never exceed about 80 degrees. In all honesty, I cannot rule out that human factors may have played a part. The long hot day standing on the concrete ramp left me feeling irritable and not too perky. It is possible that my judgement could have been impaired.

The point at which my landing gear snagged the thin wires indicated that just another two feet of altitude would probably have put me in the clear. In evaluating the position of the canard relative to a line extending from my eye level to the aircraft flight path it appears to be within the realm of possibilities that the highest thin gage wire that I struck could have been hidden from my view by the canard. With this in mind, I would caution anyone flying a canard aircraft to closely eyeball the approach area well prior to getting set up on final approach.

Besides being concerned with the utility lines at the approach end, I was equally preoccupied with the consequences of not stopping before reaching the trees at the end of the field. I suppose its a natural feeling for a pilot - especially a homebuilder to avoid anything that could inflict even the slightest damage to his creation. Had I been willing to just get it down and accept the possibility of minor airframe damage, I could have avoided all personal injury.

No other aircraft has ever come close to providing me with the great satisfaction and sheer flying excitement as N23RY did. Given the

nature of my disability (specifically, loss of ankle articulation), the rudder/brake combination of an unmodified Long-EZ represents a viable and realistic opportunity for me to get back flying again. I am contemplating a static load analysis of my aircraft which has been stored in my garage.

Amazingly, close visual inspection of the wings, spar, strakes and rear half of the fuselage reveals no apparent damage. Any builder/flyer of a properly constructed Long-EZ is entitled to utmost confidence in its structural integrity, energy absorbent characteristics and resultant crash worthiness.

My twin brother, Al, and his wife, Cathi, are heading towards completion of their beautiful Cozy later on this year. I'm really excited and will not hesitate to go up and fly that Rutan derivative.

(Signed)
Bob Yarmey

INTERNATIONAL VARIEZE AND COMPOSITE HOSPITALITY CLUB NEWS

1988 IVCHC Oshkosh Events:

Sat. July 30	Ladies Luncheon at 11 a.m. Butch's Anchor Inn
Sat. July 30	EZ Bull Session UWO EZ Lounge North Scott Hall, 4th floor 8 p.m.
Sun, July 31	Morning Social Hour, 9 a.m. - 12 Free Coffee and Doughnuts Homebuilder Type Club Headquarters "Happy Bicentennial Australia!"
Mon. Aug. 1	IVCHC Oshkosh Banquet Butch's Anchor Inn at 6:30 p.m. $14.00 per person Purchase tickets at the RAF booth

IVCHC 1988 Ed Hamlin Memorial Trophy winners are Buzz and Peggy Talbot of IL. Buzz has been an IVCHC representative for years and the Talbots have organized and hosted remarkable flyins like the Rough River Dam Flyin and the Brockridge Airpark Corn Roast. The Trophy was created by Donald and Bernadette Shupe to recognize members who have put in extra effort, time, and energy in promoting hospitality, travel and support to other EZ builders and pilots! Nominees and winners are selected by IVCHC members.
Previous Trophy winners were: 1983 - Mike and Sally Melvill, 1984 - The "Real" George Scott, 1985 - Shirl and Diane Dickey and Don and Edna Foreman, 1986 - no nominations, and 1987 - Bruce and Bonnie Tifft!

This year the Club is having its first annual "MS WORLD IVCHC" event which is sponsored by IVCHC and WICKS AIRCRAFT (410 Pine Street, Highland, IL 62249). The purpose of the event is to recognize the lady

with some, or all, of the following qualities: Friendly, Charming, and Humble personality; Airplane and Aviation Enthusiast; Helpful and Nice to Partner and Others; Good sense of Humor; Pilot and/or Co-Pilot of an Aircraft; and Pleasant appearance and carries self well.
The ladies who have been nominated for the TITLE are (in alphabetical order) Diane Dickey of AZ, Joan Hansen of AZ, Coyla McKean of TX, Sally Melvill of CA, Sasha Munir of CA and Shirley Puffer of AZ.
All members of the Club are encouraged and qualified to vote, and the winner of "MS WORLD IVCHC 1988-1989" will be announced at the IVCHC Oshkosh Banquet (usually around 250 attendees) when and where coronation will take place.

IVCHC will once again reserve rooms as a group at the University of Wisconsin at Oshkosh for the "1989" EAA Oshkosh Convention. This service is FREE - all you need to do is to send a check for $20.00 payable to either IVCHC or UWO along with your name(s), address, phone numbers, arrival and departure dates, and whether you will be flying or driving, to IVCHC/Shupes at 2531 College Lane, La Verne, CA 91750.

Staying with the group is FUN, Friendly and Memorable!

IVCHC would like to encourage communication between EZ type clubs. The Shupes have always published events and informal flyins of EZ groups, organized by members as well as non-members, so long as the meetings are friendly and geared to serve EZ pilots and builders. We would be happy to publish any group meetings and flyins - simply send us a note. Many type clubs have become quite popular because people have been willing to send news to the Canard Pusher and IVCHC for Newsletter publication. And we are most happy and proud to see that still so many wonderful people like Shirl and Diane Dickey of RACE, Dick Kreidel of LE Squadron I, David Orr of LE Squadron II, Al Coha of San Diego Squadron, Arnie Ash of Central States Assoc., EZ Builders of Florida, Dayton Ducks, and Etc., have been so highly motivated in serving EZ

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people.

If you are not members of some of these groups, you are really missing out on a great deal because between the groups "we cover everything", including promoting "hospitality"!

p.s. Thanks to Sally Melvill, Joan Richey and Dave Orr for an "Unforgettably" well organized and nicely run Burt's Birthday Party on the 18 of June - What a Party! Sorry you have to do all the setting up and cleaning up - it was all worth it, wasn't it?!!!

We sure are glad that Burt likes birthday parties! By the way, congratulations to Tonya (Burt's girlfriend, that is) for making her solo flight one day prior to the party!

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

DRAINING ALL THE FUEL PRIOR TO WEIGHING EMPTY AT THE CAFE 400 1988.

ON THE SCALES AT THE CAFE

CLIVE CANNINGS NEW DEFIANT, THE FIRST MULTI-ENGINED HOMEBUILT TO FLY IN AUSTRALIA. HE TOOK 5011 MAN-HOURS IN TWO YEARS AND FOUR MONTHS TO COMPLETE IT.

CLIVE'S DEFIANT INSTRUMENT PANEL WHICH INCLUDES NARCO AVIONICS WITH R-NAV AND A DUAL VACUUM SYSTEM.

CP56, Page 9

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

BOB AND MARGI YARMEY IN THEIR BEAUTIFUL LONG-EZ BEFORE THE ACCIDENT THAT BOB HAS WRITTEN UP IN THIS NEWSLETTER

CP56, Page 10

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THE CANARD PUSHER NO 57 Oct 88

Published quarterly (Jan., April, July, Oct.)
by

RUTAN AIRCRAFT FACTORY, INC.
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Mojave, CA 93501
805-824-2645

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Back issues	$ 3.50

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 57.
VariViggen (2nd Edition), newsletters 18 to 57
VariEze (1st Edition), newsletters 10 to 57.
VariEze (2nd Edition), newsletters 16 to 57.
Long-EZ, newsletters 24 through 57.
Solitaire, newsletters 37 through 57.
Defiant, newsletters 41 through 57.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 AM TO 5:00 PM ONLY. If you have parts that you would like us to see and/or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come other than those days, please call so we will be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please give your name and serial number. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. If you are placing an order, it's best to keep it separate from a request for an answer.

OSHKOSH 1988
As most of you know by now, it was the biggest event ever - more people, more planes, etc. Actually, it was a good show and a safe show and there were a lot of planes. Burt's mom, Irene Rutan, counted 3 VariViggens, 8 Defiants(!), 45 VariEzes, 77 Long-EZs and Burt's Catbird plus the Scaled Composites AT3 (twin turboprop) and 6 or 7 other derivatives of RAF designs. Quite a turn out.

Burt flew the Catbird from Mojave via Norfolk, NE to Oshkosh having to navigate around some early morning thunderstorms in the Las Vegas area. Mike and Sally flew their Long-EZ from Mojave, Loran-direct to Sioux City, IA, had a coke, picked up a little fuel and flew directly to

Oshkosh. They left a couple of hours earlier and missed the thunderstorms and had perfect weather all the way. Fitz Fulton (ex-NASA test pilot) flew the Scaled AT3 from Mojave to Grand Junction, CO, then via Sioux City, IA to Oshkosh. Fitz also put on an excellent flying demonstration on Saturday afternoon with the AT3, demonstrating the astonishing short field capability of the prototype twin turboprop transport.

The weather was good at Oshkosh from Friday through Tuesday when Burt, Mike and Fitz had to fly back. Except for headwinds, the enroute weather was good all the way. Mike and Sally spent one day at Durango, CO where they took the little steam train ride up the mountains to Silverton and back, a really neat trip, before returning to Mojave.

All of our aircraft performed well with no maintenance required, except for the Catbird which had a minor prop strike at Oshkosh which Burt repaired with a hacksaw and a file.

OUTSTANDING WORKMANSHIP AWARDS AT OSHKOSH, 1988
Congratulations to Arnie Ash of Davenport, IA, Long-EZ, N69AA, and to Ron Schroeder of Torrence, CA, Long-EZ, N29RS. Both Long-EZ builders were recognized for their building skills at Oshkosh this year.

A LONG-EZ FLIES INTO RUSSIA!
We have had reports of Long-EZ's that flew around the world; that flew from San Diego to Ireland and back; that flew from California to South America to Alaska; to the Bahamas, etc., etc., but we have never heard of any flying into Russia until now. Gert Martinsson of Uplands, Sweden flew his Long-EZ, SE-XFM, from Sweden to Leningrad, USSR and back in July, 1988 to visit friends. He says it took him about six months to overcome all the paperwork and bureaucracy, but finally he received a permit and successfully completed what he believes is the first flight of a Long-EZ into Russia. Gert has 400 hours on his EZ now and enjoys it very much.

CANARD PUSHER DIGEST FOR THE LONG-EZ
Stet and Kim Elliott of Governors Island, NY have come up with the ultimate tool to help Long-EZ builders find pertinent information in the CP newsletters. Using a computer, they have created what they call the "Canard Pusher Digest". They have taken the complete text of all CP articles that pertain to building, inspecting and safely flying the Long-EZ and rearranged them in plans chapter order. If a particular CP article affected more than one plans chapter, then the complete text of that article was duplicated for each chapter affected. The resulting document (over 500 pages long!) has been professionally printed on double sided paper using a computer laser printer. The Digest, which includes information from CP24 through CP56, is organized into 41 chapters. Chapters 1-26 of the Digest correspond directly to the 26 chapters of the basic Long-EZ plans. Chapter 27-41 are "Supplemental Chapters" to group CP information pertaining to

Changes to the back cover of the plans,
The Appendix Drawings,
Long-EZ Section VI, Landing Brake Plans,

Section IIL, Lycoming O-235 Engine Installation,
Optional Special Performance Canard Plans,
Optional High Performance Rudders,
Long-EZ Owner's Manual.
Weight Control
Builder Support
Builder Modifications
Long-EZ General
Maintenance and Inspections
Accidents/Incidents
Liability and Insurance
Additional Reading

Each chapter of the Digest is further broken down by sections that correspond to particular areas of interest. The first section in each chapter gives plans changes that affect that chapter. The Digest includes a master table of contents, as well as a separate chapter table of contents at the beginning of each major chapter. The Digest is extremely comprehensive, as evidenced by the chapter on the Lycoming O-235 installation, which alone is 72 pages long and includes 20 separate sections!

Stet originally envisioned the Digest to include every article in the CP's. Once it was was completed, however, Stet says it was over 700 pages long! To save printing and shipping costs, the Digest has been pared down by omitting articles that don't specifically pertain to building, inspecting or safely flying the Long-EZ. The following types of information have been omitted:

Advertisements for "one each" items that individuals (not suppliers) offered for sale. One exception is O-235 engines offered for sale. Stet felt that this information, while obviously dated, would still be of sufficient interest to builders who might want to review the price history of the O-235.

Articles and Plans Changes pertaining to designs other than the Long-EZ, and that have no relevance to building, inspecting or flying the Long-EZ. However, all of these articles were examined to see if they contained any information that could be of use to Long-EZ builders. Any articles that were found to have merit were included in the Digest.

Articles pertaining to social gatherings (i.e. flyin's), and that have no relevance to building, inspecting or safely flying the Long-EZ.

Since drawings, sketches, graphs and some tabular information could not be readily duplicated in text form, they were also omitted. A notation in the Digest, such as "**SKETCH OMITTED**" will key the user to look in the CP's to see the relevant drawing, sketch, etc.

Obviously, photographs have been omitted from the Digest. Photo captions, however, have been included for all relevant photos. The notation "(Photo Caption)" appears in the annotated heading for each photo caption to key the user to look in the CP's to see the relevant photo.

The Digest would be of enormous benefit to those who are still building their Longs. There have been cases where builders have missed important information in the CPs, and have built portions of their aircraft incorrectly. We also continue to receive builder questions about subjects that have already been covered in the CPs. Use of the Digest could solve most of these problems once and for all.

Those of you who have already completed construction of your Long-EZ's could also benefit from the Digest, especially from those chapters dealing with the Owner's Manual, Maintenance and Inspections, Accidents/Incidents, Liability and Insurance, etc. The Maintenance and Inspections chapter is an excellent reference source (along with the Owners Manual) for compiling a Maintenance and Inspection program for newly completed Long-EZs.

The Digest is truly a magnificent piece of work. Stet and Kim have put an awful lot of effort into this excellent product and it is well worth your consideration, especially the next time you can't find what you are looking for in the newsletters!

Cost of the Digest is $45.50, plus $4.00 shipping. New York state residents add 8 1/4 percent sales tax.

Stet is also considering providing quarterly updates to the Digest which would be mailed to subscribers within a few weeks after each CP is published. The update material would be compiled such that it could be inserted at the back of each Digest chapter. When you place your order for the Digest, please indicate whether you might be interested in updates as well. If there is sufficient interest, Stet may make updates available.

Stet and Kim Elliott
Bldg 12-I-2
Governors Island, NY 10004
(212) 825-0011 (after 5:00 pm)

SOME REFLECTIONS ON 3 MONTHS OF THE EZ LIFE
On the sixth of July of this year, my Long-EZ N316DB flew. Thus ended some 7 years of anticipation, occasionally very intensely focused work, and an inordinate outlay of cash. And thus began a probable lifetime of very enjoyable flying, occasionally very intensely focused work, and monumental expenditures.

The pressure was on. I had to complete my 40 hours of test flying (all within a 25-nm circle with an airplane of range of about 50 times that) within 15 days in order to make my departure deadline for The Big Trip.

The Big Trip was what had kept me motivated for the previous seven months or so. Back in December of 1987, Sid Stiber (Shelter Island, NY) and Mike and Sally Melvill and I had discussed a tour of the east coast after Oshkosh '88. I had never been to New England, or many of the areas we planned to tour, and so it was the perfect motivation. Plans were set.

And so the Runabout (as I call my Long) and I departed Mojave on 22 July bound for Kansas City. I left early for Oshkosh in order to

attend my 10th high school reunion. I climbed directly to 17500 ft and averaged about 165 ktas into (of course) about 15 kt of headwind. As I crossed Colorado, it became apparent that I was going to have to slow down in order to make the trip nonstop. By the time Great Bend, Kansas arrived, I ran the left tank dry, and has about 6 in the right. Playing the fuel flow against the time-to-go (thank you, Alcor and Northstar), I was able to arrive at Johnson County Industrial airport with about 20 min fuel left (2 gal). Total flight time was

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7 hours, 50 minutes. The distance was 1180 nm, and I used 50 gallons of fuel. I was, to say the least, extremely pleased. This was the first time that the Runabout had been away from its test area, and it had gone more than halfway across the country nonstop! I was amazed to find that I was not particularly fatigued, and I felt that after a pit stop I could have gone for several more hours.

After several more days of flying around the Kansas City area, I continued to Oshkosh. There the final details of our trip east were cemented. Mike & Sally decided that they would not be able to go after all, so Bruce and Bonnie Tifft, Sid, Dick Kreidel, and I left Wittman Field on Tuesday, 2 August for Montreal (aka the Great White North). Four-and-a-half hours later, the flight of four made a tower-requested low approach at the international airport in Montreal, and landed at St. Hubert's. Kay Kreidel joined us that evening (via airlines) in Montreal. I must say, the people that we met in Montreal went out of their way to make our visit enjoyable. It was, however, still over 450 degrees Fahrenheit outside. Sadly, this was our last experience with air conditioning for two more weeks.

After a quick trip to Burlington, VT to clear customs, we proceeded to Rockland (Owl's Head), Maine. Dick Kreidel hadn't eaten (whole) lobster before, and videotapes of the spectacle are available from Squadron 1. On to Wiscasset (Bath), ME, then to Boston (or is it Bastun?), then the Runabout and I made a ceremonial pilgrimage to Martha's Vineyard and Nantucket islands. The group rejoined at East Hampton airport, where Sid bases his Long. The next day we were joined by Peter Magnuson and his USAF Thunderbird Fighting Falcon Long-EZ. Peter and Dick and I enjoyed flying formation and 1v1v1 combat maneuvers over the coast of Long Island. Then a trip to Mattituck, to visit where Dick's engine was assembled. The next day, it was on to Linden, NJ (New York City) via Central Park, the Hudson River, and the Statue of Liberty (at 500' agl, no less!). Several days were then spent being poached in and around Central park.

Well, so far so good. The return to Kansas City went well (nonstop from Linden to Columbia, MO). It looked like a trivial trip back to Mojave. And then...

Dick and I were descending together into Farmington, NM (our planned fuel stop) when, as if by magic, the Runabout was no longer hitting on all four. We informed the tower of my problem and were cleared to land. We were about six miles out, I guess, and about 4000 ft agl. The engine was still making power (some), but the CHT on the #4 cylinder was way lower than the rest. Nothing in the usual litany of

procedures produced any good results, so I pressed on to a high overhead approach to the west. Still high, a lot of slipping, but the airspeed was high on final (about 90 kt). Better to be high than low, but this is silly. The engine won't idle below 1500 rpm or so (on the idle stop). Touch down, no problem, some crosswind but don't notice it, roll out, plenty of brake. Made it. Taxi back, park, shutdown.

Wow, bad day. I got out and went back to look at the engine area. No oil, but the prop is really beat up. Wow, Now what? Must have broken a valve, and the pieces went out the exhaust pipe and through the propeller.

But the worst came next. I looked down at the right main gear and imagine my surprise to find the wheel and wheel pant sitting about 90 degrees from where they should be. Much worse news than the engine problem!

So the trip ended with the airplane in a hangar at Farmington, and me riding home in the back of Dick's Long-EZ.

THE FIX
I was all set to get a trailer and take the Runabout apart and haul it home. I envisioned having to take the engine off, flip it over, and put a new strut in. Also, who knew what kind of engine work lay ahead?

Fortunately, I know more rational people. Dick Rutan, who had once trailered his Long home, said that no matter how much work he had to do away from home, he would never trailer his again. Burt said the same thing. Mike was convinced it could be fixed there. So it was.

Mike and I flew to Farmington in his Long-EZ the next weekend with three critical parts. First, a replacement propeller. Second, a new cylinder and all its attendant parts. And the really important one, The Splint.

Mike had made The Splint from some 1/4 inch 4130 steel strap, sort of roughly formed over his right main gear strut. The plan was to remove the axle, bend the strut back straight-ish, and install The Splint to sandwich both sides of the gear strut. The axle then would be mounted outboard of the steel piece with longer bolts.

It worked. We had thought ahead and brought two industrial strength heat guns, and these were mandatory in order to reheat the gear strut to bend it straight, for although the fibers were failed locally, the resin had rehardened to a startling degree.

I should digress and describe the failure more thoroughly. Apparently, I had used more braking than I thought during the landing (due to both landing fast and the high idle speed). Also, the other tire was low, which required more right brake. And I had the shimmy damper adjusted too tight, requiring even more brake. Finally, since the Runabout is a bit on the hefty side, I have the big brakes. More heat. The failure was in an arc, the same size and shape as the brake disk, and the mode of failure was resin burnout from direct heading of the brake disc.

The Splint worked admirably. The cylinder change went without difficulty (the piston hadn't broken, and there was no metal in the screens). In fact, the entire time on-site was less than 24 hours. The next afternoon, the Runabout completed her trip east, a cross-country of well over 6000 nm. She had 89.5 hours on the Hobbs (in less than 60 days).

After returning to Mojave, we repaired the gear strut. A particle board fixture was made for the inboard side of the gear strut, and bondoed in place. A body grinder was used to grind away about 2/3 of the S-glass strut at the bottom, tapering to nothing about 12 inches up the strut. Some dry S-glass roving (see your neighborhood Defiant builder) was wet out on a piece of visqueen and then put in place and mummy-wrapped in peel ply to hold it. The next day, the axle holes and brake cutout were transferred from the inside of the strut to the outside. Then, the inside of the strut was ground away, and more S-glass was put in place, essentially replacing the lower part of the gear strut with new material. The next day, the per-plans torsional wraps were put on, the brake line and relief tube bonded back into place, some bodywork, and Presto! a 3-day gear repair.

The next magical trick was to install a 1/8 thick aluminum plate between the axle and gear strut. This fan-shaped plate extends upward to just above the brake disc, and is intended to protect the strut from the direct radiant heat of the brake disc. The usual Fiberfrax and aluminum tape were reinstalled. The aluminum plate may seem like overkill, but I don't ever want that to happen again.

The prop was sent back to Great American for repair...$120 later, it was fixed.

Anything else? Oh yes, I replaced the other three exhaust valves with new Superior model 17540 units. I had so many people tell me how dumb I was not to put NEW exhaust valves in my engine instead of the unknown-history USED valves I ended up using, that you might think I'd have listened. But no. Instead of spending the several hundred dollars up front, I spent them later, plus about 700 more for a new cylinder, a couple of hundred for hangar rent away from home, a hundred more for the prop, and a lot of anxiety dollars for the landing duress and gear malady. But the lessons you learn, huh?
Doug Shane.

SHOPPING

NOSE MOUNTED BRAKE CYLINDERS
A few years ago, Long-EZ builder/flyer, Debbie Iwatate put together a neat little booklet containing plans for some of the neatest ideas she had incorporated into her own Long-EZ such as forward mounted brake master cylinders, a real slick roll trim modification, etc. Well, Debbie still has this

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booklet available at the same price, $20,00, but she has moved. Please contact Debbie at:

804 Cottonwood Loop
Richland, WA 99352
509-943-9579

AIRCRAFT MARKINGS
Custom made "N" numbers, "experimental" signs and virtually any other application, such as fuel grades, capacities, "no step", or "no push" markings.
Aerographics in Denver Colorado make the best we have ever seen. They do lettering and numbers in 50 different styles and sizes from 1/4" to 24" tall in every color imaginable. Their letters can be slanted, made in script or even reversed for inside a window application. These stick-on letters and numbers are cut from very thin vinyl material, correctly spaced on a paper facing with a stick back. Unroll them, pull the backing off, stick 'em down and pull of the facing paper - Viola! Perfect "N" numbers. The stick-on letters are guaranteed for 7 years! If you prefer to paint your own, they also sell the masks which stick better than any we have tried.

For those who have seen Burt's Catbird, the "N" numbers and "experimental" sign were obtained from Aerographics who will ship 2nd day air if you call their toll free number: 1-800-336-9633.

SHIMMY DAMPER
Any VariEze or Long-EZ still flying with the original shimmy damper is running a serious risk of nosewheel shimmy and possible loss of the nosewheel and fork. Contrary to popular belief, it is not a hard landing that will break the nosewheel fork. It is shimmy! Control the shimmy and the problem is eliminated. Bob Davenport has designed, and offers for sale, the best solution to this problem we have seen.
Contact: Bob Davenport
PO Box 650581
Vero Beach, FL 32965-0581
305-567-1844

HINGE PIN KITS
Gary Hall's teflon hinge pin kits are suitable for all RAF designs. The kit consists of stainless steel hinge pin material together with a pure teflon tubing sized correctly to fit over the hinge pin and inside of the aluminum hinge knuckle. This virtually eliminates hinge wear, particularly on the aileron hinges which take quite a beating from engine/prop associated vibration. Contact:
Gary Hall
4784 NW 43rd St.
Lauderdale Lakes, FL 33319
305-484-4949

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 pine Street
Highland, IL 62249
618-654-7447

Featherlite
PO Box 781
Boonville, CA 95415

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680

707-895-2718 714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

FOR SALE

Brand new 12v Quartz heater, ELT, strobe and Variac hot wire power supply. Contact:

Steve Franseen
10196 W. Keene Ave.
Denver, CO 80235
303-534-8181

For health reasons, we will not be able to complete or EZ. We have some parts we would like to sell: Continental O-200 Engine, NavCom with intercom, etc. Contact:

D. & K. Lambert
11215 161st Ct. NE
Redmond, WA 98052
206-882-2852

Rodie Rodewald would like to sell his homebuilt long range Long-EZ (rear cockpit) fuel tanks (25 + 57 gallons additional fuel). $100.00 for both.
He also has a 100 gallon long range tank for his Defiant which he does not need now that he lives on the mainland. Fits in the rear seat

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area and essentially doubles the range of the Defiant. He used it to ferry his Defiant from Hawaii to California. $100.00. Contact:

Rodie Rodewald
10681 Minnesota Ave.
Pengrove, CA 94951
707-664-0252

Cleveland 500x5 wheels and brakes with McCreary tires and tubes - never used - $200.00. Extra pair of brake calipers for above wheels - $50.00.
Wanted, new or used - Apollo 706 com., pair of David Clark H-10-30 or H-10-40, or equivalent, headsets, Whelen strobe set per RAF specs. Contact:

Avrel Mason
Rt 1 Box 184-G
Draper, VA 24324
701-980-1891

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change, as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and, that the aircraft does not need to conform to certification giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting

the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory, ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory, accomplish the change at next convenient maintenance interval or within XX flight hours whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not effect flight safety.

Please submit any significant plans changes that you may come across as you go through the building process.

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since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need help from you.

PLANS CHANGES

LONG-EZ, DEFIANT--remove, inspect & if necessary, replace the Facet fuel boost pump per page 11 in this newsletter.

VARIEZE, LONG-EZ, VARIVIGGEN, SOLITAIRE, DEFIANT - ALL AIRCRAFT. Insert the following plans change.

MAN GRD; Photocopy, clip out, or otherwise clone the placard below and install one each in your appropriate owner's manuals and easily viewed location in each cockpit, visible to each pilot and passenger seat. Also, assure that the other placards in the owners manual (Pg. 22-VariEze; Pg 24-Long-EZ, Pg. 24-Defiant and Pg. 14-Solitaire) are installed.

As we have discussed previously in the Canard Pusher and as has been reported by Aviation Consumer magazine, the experimental homebuilt airplanes have an accident record that is worse than that experienced with certificated, factory-built aircraft. This is due to a number of factors. There are more chances for non-conformality to occur, thus each airplane built is actually a new, experimental, research, high-risk

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article. This new research aircraft is often tested by pilots who have very little time in type and who often do not follow careful flight safety procedures in their testing. Also, because these aircraft are more fun to fly and have higher performance, many accidents are the result of improper aerobatics or other high-risk flying.
For example, as we reported in CP47, seven of the eleven Long-EZ accidents occurred during low altitude buzzing or aerobatic maneuvers. Because many individuals, including those who may purchase one of these aircraft or may ride in one as a passenger may not be aware of the risks involved, we are including a plans change in this newsletter requiring placarding the aircraft and the owner's manual.

WARNING!
STATISTICS INDICATE THAT AMATEUR BUILT AIRCRAFT ARE MORE LIKELY TO HAVE AN ACCIDENT, INCLUDING A FATAL ACCIDENT, THAN FAA CERTIFICATED, MANUFACTURED TYPES. WHILE STRICT ADHERENCE TO OPERATING PROCEDURES CAN REDUCE THIS RISK, THE HAZARDS ARE SIGNIFICANT, PARTICULARLY DURING INITIAL FLIGHT TESTING OR WHEN OPERATED IN A NON CONSERVATIVE MANNER.

MAN GRD: Conduct an inspection or provide a certification that the elevator quality regarding correctness of laminate schedule, orientation of plies, numbers of plies and workmanship relative to the weight of the layup and straightness of the primary surface is correct. This should include inspection or verification that additional filler materials have not been added to increase the elevators weight and thus change is natural frequency of oscillation. If you have purchased structure from someone else and cannot otherwise verify the structural quality and conformance, conduct a dissection of the elevator skins to assure the proper structure, or better yet, discard the elevator and build new ones that you know are in conformance with the tested and approved configuration. Any variance in weight, stiffness, or shape should be suspected of being dangerous and not allowing you to rely on the testing that was conducted to verify freedom of flutter. The weight limits shown are absolute maximums. A properly fabricated, accurate core with a properly squeeged minimum-resin laminate will result in weights well below the limits shown in CP 21 pg 5. In order to provide more margin for variables in this extremely important area, we are now recommending that any elevators that require additional mass balancing beyond those weights shown for the basic configuration be discarded and new elevators fabricated. If you are unable to build elevators that can be balanced by the basic balance weights, both inboard and outboard, you are possibly unable to produce adequately safe flying components. Do not compromise by using up to your margin of safety by merely increasing balance weight. This increases the weight of the elevator and lowers the frequency of its oscillation. Above all, be certain that your elevators meet the balance hanging angle of 12 to 20 degrees after painting. If there's any doubt that they are absolutely perfect, discard them and start over. It is possible, with proper tube orientation, to retain the aluminum tubing when building new elevators.

VARIVIGGEN
Install this placard summary in the VariViggen cockpit and owner's manual.

COCKPIT PLACARDS

Solo - Front seat only
Minimum pilot weight - xxxlbs.
Maximum pilot weight - xxx lbs.
Maximum gear extension speed - 90 mph
Maximum speed with gear down - 120 mph
No aerobatic maneuvers are approved
Intentional spins are prohibited
Maximum wind for taxi - 40 kts. (all quarters)
Maximum crosswind component:
for take-off - 15 kts.
for landing - 20 kts.

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Fuel tanks(s) - xxx octane rating, xxx capacity (near fuel cap)
Red line speed - 185 mph
Maneuvering speed - 125 mph
Maximum gross weight - 1700 lbs (150hp), 1860 lbs. (180hp)
Center of gravity limits - forward - 119.0, aft - 126.0.

ACCIDENTS AND INCIDENTS

A TEXAS HOMEBUILDER took eight years to complete his VariEze. His total experience consisted of about 150 hours in Cessna 150's and 172's. He had not flown solo for some time. He called RAF and explained what had happened. He successfully made his first flight, although it was very short and he had a lot of trouble with pitch control. On the second flight, during the take-off and climb, he again had difficulty with overcontrolling in pitch. At higher speeds, it flew great, but when he slowed down to land, he got into a PIO (pilot induces porpoising), got slow while trying to get it under control, the EZ pitched up then pitch down, crashing hard on the runway. The nose gear and left main gear were torn off; the prop and lower winglets were broken.

By his own admission, this pilot said he was anxious to fly, but he overstepped his ability and his experience. He says, "Don't lie to yourself, don't fool yourself. If you are not ready, get someone else to fly it and check you out, or get the necessary training".

We appreciate this pilot's honesty and his guts in calling us with this accident report. Don't kid yourself into believing you can do it if you know in your heart that you are not ready - profit by this pilot's experience - it cost him his airplane and eight years of hard work. Don't let it happen to you.

A CENTRAL CALIFORNIA VARIEZE experienced in-flight severe flutter of the elevator and canard which caused a structural failure of the canard, and the pilot was killed when his VariEze crashed on a wooded hillside. He had about eight hours in his VariEze before the crash.

He had not built the airplane but had purchased it with all of the structure done. He then completed the finishing and systems installation. The elevators were carefully checked for correct balance

and some weight was added inboard on each elevator to bring the elevators into the proper balance tolerance.

Prior to the fatal flight, the pilot had removed the canard to check something in the nose. Previously, a friend had helped him to install the canard and noted that he had had great difficulty in getting the canard attach bolts to line up and thread into the nutplates.

A very careful post crash investigation by the FAA, as well as by RAF, determined that the probable cause of the catastrophic flutter was that one of the canard attach bolts was not correctly installed. Either it was not torqued up at all, or it was cross threaded. In any case, it did not clamp the aluminum lift tab to the F-22 bulkhead. This resulted in the natural frequency of the canard being lowered considerably since it was only firmly attached on one side. A gust, or something, excited the elevators driving the canard into a divergent destructive flutter mode.

Although the elevators were balanced, they were very heavy, having been modified from the original short chord design to the long chord by the addition of a large heavy piece of balsa wood and several plies of BID. This caused the elevators to have a lower natural frequency of oscillation. Thus, these overweight elevators may have contributed to this accident, however, the primary cause was the failure of the pilot to properly install the canard.

This tragic accident brings it home to all of us, just how careful we must be as we work on our aircraft. When you are doing a critical job such as installing a wing or a canard or a control surface, you, and only you, are responsible to ensure that all fasteners are correctly installed and properly torqued. Too often we get sidetracked while working on a critical installation when we get interrupted by a friend or passerby. Should this happen to you, do not stop until you have the critical

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part installed and safetied - even if you have to be rude to your visitor.

Accidents such as this have been caused by an interruption or disruption of your thoughts while working on an important aspect of the aircraft. A simple example is changing the oil. The oil is drained, the drain plug replaced, then a visitor shows up with a bunch of questions - you forget to fill the sump with fresh oil and - presto - a destroyed engine when you start it. It happens so easily, it seems so unlikely, but it happens. Be conscientious, use checklists, be very particular and careful if you have removed a canard or wing or canopy, etc. Be absolutely certain you have adequately completed any task you do on your airplane. Last of all, be very conscientious about doing a thorough preflight on your creation before you commit you, and perhaps a member of your family's or a friend's, life to your workmanship.

As you know from past Canard Pusher newsletters, the subject of flutter has been a major concern for years. CP numbers 17, 18, 19 and 21 have reported discussions and/or warnings relative to the importance of

conformality in the fabrication of the canard and elevator system. It is extremely important to be aware that elevators improperly fabricated, too heavy or with the incorrect bending or torsional stiffness characteristics which result from improper materials, or fiber orientation, cannot be balanced with any method.

A mass balance called out for the elevator and the specification for balancing them, applies only to an elevator fabricated with the same weight and stiffness as that which has successfully passed all the flutter testing. It is extremely important, and life-critical, that the manufacturer or owner of each VariEze, Long-EZ or any plane for that matter, assure, without a doubt, that the control surfaces are conformal to those which have passed flight tests and been shown to be flutter free.

The advisory shown in the plans change section must be followed to assure that there are no non-conformal elevators that could contribute to, or result in, an accident. Do not take this situation lightly. As we have indicated before in the CP, - IT COULD KILL YOU.!

MAIN GEAR LEG OVERHEATING
Suddenly, we are receiving a number of reports of softening main gear problems. This subject has been covered before, but there is now a new factor so it bears mentioning again.

The new factor is, or course, the very popular "big" brakes, particularly for the Long-EZ. We believe that big brakes are aggravating this problem and we feel that it may be appropriate to install an aluminum heat shield between the brake disc and the main gear strut. We have done this quite easily by cutting a piece of 1/8" thick 2024-T3 aluminum that fits between the axle flange and the strut, and is clamped in place when the four AN-4 bolts holding the axles on are tightened. The 1/8" thick plate will probably require the use of one size longer AN-4 bolts. This heat shield should be tall enough to protect the strut to about one inch above the brake disk, and should be wide enough to prevent the heat radiating out of the disk to "see" any of the main gear strut. (see Doug Shane's article: EZ LIFE.)

Several Long-EZ's are flying now with these heat shields with no further problems reported. Don't let it happen to you. Never do taxi tests, low speed or high speed, with wheel pants installed. Be aware that your brake discs can, and will, get red hot. This heat can radiate directly into the "S" glass and epoxy strut. Once the epoxy in the strut reaches its heat distortion point, the strut will fold up, an extremely frustrating experience at best, requiring extensive repair or replacement of the strut. If this happens away from home, it can be even more frustrating. Take care of your main gear strut and it will take care of you with years of trouble-free service.
1) Wrap the strut with fiberfrax covered with Reynolds wrap or aluminum tape. Use RTV silicone to glue the fiberfrax to the strut.
2) Install the 1/8" aluminum plate heat shields.
3) Cut vent holes in the TOP of your wheel pants to vent the hot air inside, after a panic stop.

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4) Plan your taxiing and landings so as to use minimum braking - better to roll to the end using little or no braking, than to brake violently in order to make the first turn off.

LONG-EZ, DEFIANT, ELECTRIC BOOST FUEL PUMP ALERT.
Returning to his home base airport after a flight, a Southern California Long-EZ pilot was approaching the 45 degree entry to downwind when, abruptly, his engine quit. He was unsuccessful in getting it restarted but, to his credit, he flew the airplane, announced his situation and made an uneventful, successful landing. Feeling a little weak around the knees, he pushed his airplane into his hangar and went home.

The next day, he conducted a careful examination of the aircraft and discovered that the Facet solid-state fuel pump was completely blocked and would not allow any fuel to pass through to the engine driven mechanical pump! One of the two valves in the pump had deteriorated in the 100LL fuel and had worked its way out the metal cage that normally prevents this, and had been sucked into a position that prevented the flow of fuel. The part number on the mounting flange of this pump was 480615. The plunger valve was made of VITON - this pump is no longer being manufactured.

Before next flight, check the part number of your pump. If you have one of the following part numbers 40023, 480615, 480616, remove the pump and replace it.

The most desirable Facet solid-state pumps that we recommend are part #40108 for 12 volts and part #40154 or 480610 for 24 volts. Both pump fuel at a regulated maximum 6 psi, and the valves in these pumps are pure nylon which, other than swelling very slightly in avgas, are not affected nor do they deteriorate. The design of these valves (the foot valve and the plunger valve) are such that they cannot physically get into a position where they can prevent fuel from flowing through the boost pump. Both the above pumps have AN-style 37 degree flare fittings which fit 3/8" tube, AN 818-6, nuts.

Facet manufactures over one hundred variations of the small square solid-state fuel pumps. The above two pumps have AN-type flare fittings machined right on the pump bodies and we prefer this type because they are easy to install (no elbows or nipples required), but also because these two models have only nylon valves, no rubber, Buna, or Viton. Many of FACET's other models have Viton plunger valves or Buna N check valves and these will deteriorate in avgas. These are specifically for use in some other liquid known not to affect these materials.

To check your pump, remove it and look into the inlet and the outlet using a small flashlight and verify that the inlet valve (foot valve) is a round, white dome or ball (nylon), not a flat, black rubber disc. Verify that in the outlet there is a white nylon valve under a steel pin which crosses the port and retains this valve. If this valve is dark gray or black (Viton), remove the pump before next flight and discard it. If you have a pump with female pipe threads (to accept elbows or nipples) due to your firewall layout, choose one with 3/8 NPT female threads rather than the 1/8 NPT female threads, but examine it closely to be sure it has white nylon valves in the inlet and the

outlet ports. Discard it if there is any black or gray Viton, Buna N or rubber valves.

If you have had your Facet fuel pump more than a year or so, you probably have one that could go bad. AT a cost of approximately $30.00, it is not worth the risk. Remove it, discard it and install a new one as called out. We believe that the serious consequences that could result from a fuel supply stoppage, more than justifies the immediate replacement of any suspect pump.

We have replaced the boost pumps on Burt's Defiant and on Mike and Sally's Long-EZ and we recommend in the strongest possible terms that you do the same.

AEROQUIP GENERAL AVIATION ALERT NOTICE.

RECALL ON AEROQUIP 601 HOSE.

This week, we received a notice in the mail with the above title. If you look back through past issues of the CP, you will find that we have been reporting incidents with Aeroquip 601 hoses since 1986 (see CP49, and CP52).

We have had these hoses spring a leak in the middle of the hose (not at a fitting), and we recommended Stratoflex hoses instead. We use nothing but Stratoflex hoses on all of our aircraft here at RAF and that is still our recommendation.

This notice says, essentially, that if you made up the hoses yourself, as we have often done, and you obtained the hose from between April 1984 and May 1988, remove it from service and replace it. If you had these hoses made up professionally, they should have a metal identification band. On this band will be an assembly date and cure date shown as follows:
A2Q87 - assembly date, 2nd quarter, 1987
1Q87 - cure date, 1st quarter, 1987.

If you have such a set of numbers you can identify, remove the hoses if the cure date is between the first quarter of 1984 and the third quarter of 1987. Contact an authorized Aeroquip hose shop and they will supply you with new hoses. You will be billed for these until the authorized distributor receives your removed, suspect hoses, then you will be credited in full.

This note is more than a mandatory AD. A leaking hose could easily cause a fire which could have tragic results. Check your hoses and don't fly until you have replaced them.

PAINT 'EM WHITE
We are alarmed by the trend to paint composite aircraft dark colors. An orange or dark blue or dark red surface, can easily reach a temperature of 190 degrees on a warm sunny day with no wind. We saw at Oshkosh 1988, a deep orange Velocity and a dark red Lancair, parked, unprotected in the hot sun. We would not have flown in either of these

aircraft for any reason.. All RAF airplanes use room temperature cured epoxy in their construction and these room temperature epoxies have a heat distortion point of only about 150 to 160 degrees F. All of the composite aircraft that we are aware of in the USA, at least, also are put together using room temperature curing epoxies or vinyl esters. Don't be lulled into a sense of false security by the examples of those who must not have considered the possible consequences of their actions. Paint your airplanes white.

MAGNETO WIRING CHECK PRIOR TO SHUT DOWN.
The other day, Burt came in from a flight in his Defiant and reported a broken wire on the right rear magneto. He discovered this condition because, it has always been his habit, he conducted a magneto wiring check just before he shut the engine down.

How many of us do this with any regularity? How many do it at all? If you have never done this check, you may possibly have a "hot" magneto, even though you have both mag switches turned off. This is a potentially dangerous situation. Anyone who moves the prop may suffer a prop strike. Many people during the history of aviation have been seriously hurt, even killed, by a "hot" magneto.

The procedure to check if both of your magnetos are correctly grounded, is as follows: Just before you pull the mixture to shut down your engine after a flight (be sure the avionics master switch is off), momentarily flip both mag switches off and then back on. This only needs to take a second or so. The engine should instantly quit. If it continues to run, you have one or both magnetos "hot" or not grounded. Remember, a magneto is always hot unless it is connected to ground. Your mag switches should connect each magneto to ground when they are in the off position. Check the wiring at the magnetos or between the firewall and the magnetos. This is the most likely place for the wiring to fail due to the movement of the engine during start-up and shut down. Be sure to have adequate strain relief for the wires, and don't have the wires from the firewall to the engine too tight - you need adequate length to allow for the considerable movement of the engine relative to the airframe.

Try to develop the habit of conducting this test each time you shut down; power to idle, avionics off, both mags off for a second, engine should abruptly quit, mags back on, engine should catch and run, then mixture to idle cut off as normal. Knowing, for a fact that your magnetos are indeed grounded and that anyone, including yourself, is not likely to get surprised by the engine suddenly firing when the prop is moved is very comforting.

STICKING FUEL VALVES (AGAIN)
On at least three occasions, we have brought up this subject in past CP's. We continue to hear from EZ builders and flyers that they are still experiencing occasional problems. Thanks to Long-EZ builder/flyer, Jim Evans of Yorktown, VA, we have what we believe to be an excellent alternative to the present brass valve with the tapered brass cone that sometimes sticks!

Jim tells us he has over 80 hours on his new Long-EZ and has used a "Whitey" valve which has a stainless steel body, stainless steel ball and stem and uses pure teflon seals. Stainless and teflon are not affected by fuel and these valves are easily available - and they turn smoothly! We obtained one of these valves and Mike has installed it on his Long-EZ and is extremely pleased with it.

The valve body is machined from solid 316 stainless steel bar stock, as is the one piece ball/stem. The ball, itself, (not a cone) is encapsulated between teflon seals which can be adjusted without removing or disconnecting the valve.

There are several sizes and fitting styles available. The Swagelok fittings look good but are not what we are used to in "aircraft style" fittings. The valve we are recommending for all VariEzes, Long-EZ's and Defiants, is Whitey's catalog number SS-44xF4. This valve has an orifice through the stainless ball .281" in diameter, has female 1/4 NTP pipe threads in the inlet and left and right outlets. These will accept the AN 822-6D 90 degree elbows. The one piece stainless ball/stem eliminates any backlash and the black plastic handle has positive stops for left and right positions. The "off" position is in the center and does not have a positive stop. The handle points left for the left tank and right for the right tank. We checked the flow rate through this valve, using gravity and a 6" fuel head (simulating the worst case, low fuel in a gravity feed VariEze). We measured almost 30 gallons per hour, more than adequate for any VariEze and, of course, for the pumped systems on Long-EZ's and Defiants - probably an "over kill" - however, keep in mind that there have been two incidents that we know of where the pilot had a forced landing due to a stuck valve.

These valves can be obtained from your local Whitey distributor. We obtained ours from Bakersfield Valve and Fitting Co. in Bakersfield, CA. Contact Whitey Co., 318 Bishop Rd., Highland Heights, OH, 44143, for the name of your nearest distributor. Phone-

ELECTRICAL WIRING AND ASSOCIATED PROBLEMS

Wiring an airplane is relatively easy for some builders and very difficult for others, depending on your background/experience. If you are one of the latter, try contacting Bob Nuckolls. Bob has been in electronics and aircraft wiring for over 20 years and is incredibly knowledgeable about the dumb little nit-picking questions I always seem to have. Finally, here is a guy that can answer these questions and not only that, but he speaks a language even I can understand! The best news of all is that Bob is now writing a neat newsletter called "The Aero Electric Connection". He plans on producing two of these a year and the subscription is $20.00 annually with a $2.00 deduction if you an EAA member and a further $2.00 deduction if you are a member of AOPA.

The first edition, Volume 1, number 1, is now out and we have it in our hot little hands! It is excellent. He encourages you to send him wiring problems or questions which he will research and answer in his newsletter. What a deal, this man knows his electrical stuff and we heartily recommend subscribing to his newsletter or, at least, writing him with your question.

Bob works with Bill Bainbridge of B&C Specialties and the linear voltage regulator Bill sells is one of Bob's designs. Contact Bob Nuckolls at "The Medicine River Press"
PO Box 12703
Wichita, KS 67277-2703.

TIME FOR AN OVERHAUL? TIRED OF LEAD FOULING YOUR PLUGS?

If you have an O-235-L2C and it is getting tired or fouls its spark plugs in spite of using REM37BY Champions, this may be something to consider.

Light Plane Maintenance, October, 1988, Vol. X, No. 10, page 21, suggests an interesting compromise. You can get rid of the -L2C's tendency to lead-foul spark plugs by having Engine Components, Inc., 9503 Middlesex, San Antonio, TX 78217, 512-828-3131, convert your engine. ECI has STC's to convert your present 7/16" exhaust valves to O-320 1/2" valves and to machine an anti-lead-fouling valve pocket into the cylinder heads. This pocket increases the cylinder volume by approximately 5% which enables you to install the -F high compression pistons without ending up with too high a compression ratio. Your standard -L2C has 8.5:1 compression, the -F has 9.7:1, but the above conversion would give approximately 9.2:1.

According to Light Plane Maintenance, "This might offer the best of several worlds: A little higher horsepower (122hp approx.) reduced lead fouling problems and better knock resistance than the 125hp -F engine." You should get more power and longer life out of your O-235-L2C.

This mod is not recommended for the low compression O-235-C2C which does not suffer from lead-fouling and is generally extremely reliable. Also, these older O-235 LYC's do not have crankcase through-bolts. High compression pistons would certainly result in a lower TBO, or worse. Contact Engine Components, Inc. for prices, and keep in mind, with the extra horsepower, you will need one-to-two inches more pitch in your prop. (Submitted by Buzz Talbot, Long-EZ builder/flyer - Thanks, Buzz).

A subscription to Light Plane Maintenance costs $72.00 for 12 issues (expensive, but worth it), PO Box 359135, Palm Coast, FL, 32035.

CONGRATULATIONS John Steichen! First Flight of his Defiant was October 10, 1988. John's is the 14th Defiant to fly that we know of. Of these 14, 8 of them were at Oshkosh - pretty good percentage!

John had some nosewheel steering problems prior to his first flight and we will have a summary of those problems and solutions in CP58. Defiant builders are a determined bunch. We know of several more very close to flying and we believe that, eventually, all of the Defiant plans out there will one day be airplanes.

Owner's Manual and cockpit placards omitted

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Sad but true! - the result of heavy braking & riding a brake.

It took two heat guns to warm the epoxy enough to straighten the strut.

Fitting The Splint!

A perfect fit!, incredibly the toe-in was even correct!

Baffling! .032 6061-T6 aluminum. This is how it should be done. The neoprene/asbestos material still has be installed.

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Burt's birthday party - can you guess where Burt is? Clue - find the catbird. **PHOTO OMITTED**

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 58.
VariViggen (2nd Edition), newsletter 18 to 58.
VariEze (1st Edition), newsletters 10 thru 58.
VariEze (2nd Edition), newsletters 16 thru 58.
Long-EZ, newsletters 24 through 58.
Solitaire, newsletters 37 through 58.
Defiant, newsletters 41 through 58.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 AM TO 5:00 PM ONLY. If you have parts that you would like us to see and/or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come other than those days, please call so we will be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please give you name and serial number. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. If you are placing an order, it's best to keep it separate from a request for an answer.

RAF ACTIVITIES
We apologize for the CP being late. The Pond Racer, a twin, piston engine, propeller driven, unlimited racing plane, designed by Burt and being built at Scaled Composites, has been a high priority project that Mike Melvill and some of the others still working in the old RAF building have become involved in. The main gear, elevators and ailerons have been built by this small group and will be integrated into the all carbon-fiber Pond Racer. It is intended that this aircraft will become the fastest piston/prop driven aircraft ever built and Mr. Bob Pond intends to win the Unlimited Class at Reno. A very exciting project and a real challenge to work on. The engines will ultimately develop 1000hp each, and the wing area is about the same as a Long-EZ! Should be quite a kick in the pants to fly!

The Catbird now has a fully functional S-Tec System 50, two axis auto pilot installed, thanks to Dusty Rhodes of Vista Aviation on Whiteman airport in the Los Angeles basin and to S-Tec of Mineral Wells, Texas. It took several iterations to get the auto pilot matched up to the rather zippy control rates of the Catbird but it was worth it. It works so great it has made all of us EZ flyers wish we had one! It is quite expensive but for anyone flying much IFR, it would be extremely helpful. Any Long-EZ or Defiant flyers who are interested in an auto pilot should give Dusty a call at Vista Aviation. He has installed several of the S-Tec System 50 auto pilots in Long-EZ's and other high performance homebuilts and was extremely helpful to us on the Catbird installation.

FIRST FLIGHTS

Congratulations to Don Wimple who recently made the first flight of his Solitaire, N78DW, at Hemet, CA. Don is the first we know of to use the Solitaire self launch capability to make his first flight.

Congratulations to George Craig on the first flight of his VariViggen, N31GC, at Tracy, CA. George has worked on completing his SP wing version of the Viggen for almost 12 years. Good show, George.

Congratulations to John Steichen who made the first flight of his Defiant, N27EZ. John had it ready to go over 6 months ago but, unfortunately, had an incident during a high speed taxi run when his nose wheel steering diverged and the Defiant left the runway and was damaged in the ensuing ditch crossing. All that is behind him now, all repairs and modifications completed and John says it flies great!

Congratulations to Don Foreman who has finally overcome all of the problems of getting his Defiant, G-OTWO, licensed in England. Don had the English CAA overload his canard, and fail it, in a required static load test. He has had severe nose wheel shimmy, magneto problems, prop problems, his electric pitch trim system failed (he now has an excellent manual system), he had a brake lock up, he had carburetor and induction problems, but, the good news is that finally he has got all these problems sorted out and much to his delight, the CAA test pilot has conducted a very successful flight test evaluation of his Defiant and has pronounced it to be excellent. He has issued Don a permit to fly. Super job, Don. How about bringing it over to Oshkosh 1989?

DEFIANT REPORT

There are now at least 15 Defiants flying that we know of. All of the builder/pilots who have reported to us are pleased with their Defiants, however one problem in particular has occurred to many of these airplanes. During taxi tests and high speed taxi runs, divergent nose wheel steering has occurred, sometimes getting so bad that the airplane has left the runway. John Steichen had just such a problem which caused him to leave the runway at around 70 KIAS. He ended up in a drainage ditch with a broken prop, broken rhino rudder and a failed nose gear. A devastating situation for someone who has worked so hard to get to this point. Our discussion and suggestions to John are

printed here in the hope that they may benefit other Defiant builders approaching this stage.

Burt's Defiant, N78RA, has never had a divergent steering problem but it certainly did have a few serious shimmy problems early on in the program. These problems were completely cured by rebuilding the nose gear assembly (done by Mooney at Kerrville, TX), and by the addition of an efficient hydraulic shimmy damper (no damper was installed initially). No further nose wheel shimmy or steering problems have occurred in something over 1100 hours of operation with numerous pilots.

This problem has been aggravated by a very confusing drawing put out by Mooney showing the axle centerline AHEAD of the steering pivot!! The dynamics of a trailing link nose wheel (such as the Mooney nose wheel) are such that, if the axle centerline is on or forward of a line extended down through the center of the steering pivot, the nose wheel will be neutrally stable to unstable and may diverge or dart left or right, uncommanded. If the axle centerline is aft of this line, it will be prone to shimmy. Shimmy is similar to flutter and can be instantly destructive. Uncommanded, left or right divergence can be equally destructive by driving you off the runway across a ditch. So what to do? Set the axle centerline aft of the line through the center of the steering pivot by 0.6 to 0.8 inches. Control any tendency to shimmy by installing an hydraulic shimmy damper shown in the plans.

Roger Rupp from Alaska had similar problems to John Steichen's. Rodie Rodewald, also, had divergent steering problems when his nose wheel was adjusted per the Mooney drawing. Some others who have also had varying degrees of this problem:. Dr. Yost of Alabama, Don Foreman in England, Dr. George Best in Phoenix, Arizona. Some saw heavy steering divergence at low speed. Scary, but not destructive, probably caused by having the axle centerline too far forward. Some did not see this divergence until traveling much faster, caused almost certainly by the nose wheel swinging forward of the steering pivot line as the canard started lifting the weight off the nose wheel.

The nose wheel geometry should be set with ZERO weight on the nose wheel, to 0.6/0.8 inches aft of the steering pivot line using the Mooney spacer washer (SB #20-202-3, 1-1/4

OD x 1.010 ID x .120 thick, 4130 N steel finished in zinc chromate). John Steichen suggests that it may even take two of these washers, at least it did on his 4 donut Mooney nose gear. (see sketch, page 15).
SKETCH OMITTED

Another factor that may influence the likelihood of shimmy, and/or divergence, is rotation speed. If your Defiant rotates at 60 to 65 KIAS, you may not see any shimmy or steering divergence simply because you have not reached the speed at which either of these phenomenon may have occurred. Some Defiants do not rotate until indicating 80 Kts or more. This may be caused by one or more of the following problems: Forward CG, or too far forward CG. Two large people in the front, nothing in he rear seat, no baggage and minimal fuel will put your CG

forward. Fill her up with gas, and the CG will march rearward. Main gear axle centerline too far aft will cause the Defiant to act as though it has a forward CG condition while rolling on the runway but may be normal to aft CG once airborne. Having the main gear too far aft will really extend the take-off roll and will require a higher than normal rotation speed. This is tough to fix. Take great care while building not to end up with this problem. Do not be tempted to move the axle centerline forward either, because this will result in a real problem when loading baggage. The Defiant may tip over on its winglets and could break the prop. Put the main gear axles where the plans call for them to be. Ground attitude. A nose down ground attitude puts the canard and the wings at a negative angle of attack during the take-off roll and can greatly increase the rotation speed causing you to use a lot more runway and putting your nose wheel at risk due to excessive speed. Even a correctly set up nose gear may shimmy if it hits ruts or bad bumps at too high a speed. If your Defiant sits nose low with both engines installed and some fuel, perhaps 1/3 on each side, you have a problem. Burt's prototype, N78RA, with the above conditions sits with the flat bottom (from forward firewall aft 3 feet or so) slightly nose up. Check with a two foot level held bubble level. (see sketch, page 15). **SKETCH OMITTED**

If your plane is not close to this angle, you may have to change the ground attitude. The easiest way to do this is to cut some amount off the main gear strut. You will have to determine how much by calculation after doing the above check. NOTE: You should push the airplane forward on a level ramp at least 100 feet to allow the main gear to relax to its natural position (this is driven by wheel toe-in/toe-out. Your wheels should not toe-out. They should be zero toe-in to a maximum of a total of 1/2 or 1/4 degree each wheel). If it sits nose low at this point, jack the nose wheel up or shim it with scraps of lumber until you have the required nose up attitude. Now measure the stack of lumber scraps under the nose tire - this is the amount you will have to cut from each main gear strut. The only negative side to cutting the main gear strut is, of course, less rear prop tip clearance. This is not too much of a problem with a Defiant since the rear prop has much more tip clearance than, say, a Long-EZ. The added work of remounting the axles will be well worth the effort. While you are at it, it is best to mount the brake caliper on the forward side of each strut. Better ground clearance with a flat tire and a better brake line run inboard of the strut which gives more flexibility to the brakeline to allow the caliper to move laterally with brake pad wear. One more important point - all Defiants should be using low profile tires, Goodyear 15x600x6. If you use standard 600x6 tires, you will set your axles approximately 1-1/2 too high.

There is one other way you can help lower your rotation speed. It consists of reflexing both ailerons trailing edge up by adjusting the fore/aft aileron pushrods in the wing roots equally to raise the trailing edges of each aileron up to a maximum of 3/16" (measured at the outboard tip of each aileron relative to the wing trailing edge). This should be done with caution and in small increments with careful flight testing after each adjustment. The effect of reflexing the ailerons is a nose up trim change. This will lower rotation speed but, and this is important, it will also allow you to command a higher angle of attack and this may cut down on the stall margin of your main wing.

If at any time you see uncommanded wing rock, even if you can null it out with a stab of the aileron, DO NOT

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reflex the ailerons any more. Our experience has also shown a small aileron authority increase with reflexed ailerons. This is a test worth trying but we believe you should have some experience in your Defiant first. You should approach this kind of testing in a professional manner, make small changes each time. Flight test each change and document the results. Use good judgement and quit if you see any roll authority degradation or any uncommanded wing rock (caused by asymmetric-flow separation on each wing, probably outboard of the ailerons). A few tufts (3" long pieces of yarn taped on the wing with masking tape) on top of each wing will give you visual warning of impending wing rock before it actually occurs.

BIRDSTRIKE! BIRDSTRIKE!
"On the Sunday after Thanksgiving, my wife and I departed Inyokern airport (Mojave desert) for a casual Sunday morning flight in our Long-EZ. I climbed out to 5500 feet MSL (approx. 2500 feet AGL), leveled off and throttled back to approximately 150 mph TAS. I looked up just in time to see a bird about 50 feet above my flight path and several hundred feet ahead. I didn't have time to determine its direction of flight or which way I could turn to avoid it. I had probably less than 2 seconds between first sight and impact. Just before impact, the bird winged over and dove down, striking the canopy head on .....instant explosion/implosion? The canopy was shattered and completely missing from my head forward. From my head back, the canopy stayed intact.

The bird and/or plexiglass struck me, knocking my headset off and giving me a fat lip. The bird ended up in the back seat. My glasses were undisturbed.

I immediately throttled back and nosed up slightly to reduce airspeed to keep the debris from flying around and anything else from ripping out. I was in control of the airplane at all times and slowly turned for the airport 8 miles away. I reached for my headset microphone, cupped my hand around it and declared an emergency. I was later able to put my headset on while my wife took the stick.

We proceeded to motor back to the airport at about 100 mph. The direct wind in the face was no worse than riding a motorcycle at 80 mph. My glasses stayed put with no problem. The plane flew fine and a normal landing was made.

The prop was totaled. There was a chunk missing from each blade (approximately 1" x 1/2" x 1/2") and one blade had a split from the tip toward the center about 10" long. I experienced no noticeable vibration on the flight back or in taxiing. The bird's head was missing and probably went through the prop. The leading edges of the prop were severely chewed up by the canopy fragments. The webfooted bird (Duck??) weighed in at 1-1/2 pounds. My wife was bloodstained but unhurt with a duck in her lap.

My canopy was formed from 1/8" thick plexiglass. The manufacturer increased the thickness for Long-EZ canopies to 3/16" a few years ago.

Prop and canopy: On order!

Gary Spencer"

EDITOR'S COMMENT
Char and Gary Spencer's experience with a birdstrike that broke the canopy is the first reported EZ incident of its kind. Gary remained cool and FLEW THE AIRPLANE and with no further problems, made a safe landing at his home airport. Congratulations, Gary!

We have had several reports of birdstrikes on the canopy, as well as other parts of the airframe, but none resulting in a broken canopy. Now we hear from a Texas Long-EZ builder/flyer who inadvertently took off without latching his canopy. His safety catch had been bent so it did not catch as it should have and the canopy opened rapidly, and with enough force to fail the "throw over" canopy stay bracket on the canopy frame. This allowed the canopy to open beyond its normal position and smash into the right fuel strake, breaking the plexiglass canopy into small

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pieces. This occurred right after lift off and, to make matters worse, it was raining! Well, our intrepid pilot remembered to FLY THE AIRPLANE. He ignored the canopy problem, slowed down to cut down some of the stinging effect of the rain and flew a normal pattern back to a safe landing on the same runway he had so recently departed from. Apart from the stinging raindrops, he suffered more from hurt pride than anything else. His canopy frame was in perfect shape, all the plexiglass was gone, but incredibly, there was no damage to his prop! Presumably, the pieces departed toward the right winglet with enough velocity to completely miss the prop. He reports that the Long-EZ flew OK, he had no trouble maintaining control or in making a normal landing. Now he is faced with the unenviable job of replacing the plexiglass canopy.

All of this goes to show that as long as you continue to think and continue to FLY THE AIRPLANE, you can fly away from even this kind of a serious emergency problem. Replacing the plexiglass is tedious, hard work but it can be done, and it's a lot easier than trying to repair a badly damaged airplane - or worse.

1) NEVER fly with your canopy warning system inoperative - NEVER EVER.
2) CHECK YOUR SAFETY CATCH FOR CORRECT FUNCTION BEFORE EVERY FLIGHT, it could save your canopy or even your life. - NEVER FORGET that there have been several fatal accidents because the canopy opened on take-off or in flight.
3) IF you are unfortunate enough to have an emergency situation such as an open canopy in flight, if you do nothing else, FLY THE AIRPLANE, then, and only when you have the airplane under reasonable control, you might consider what else you could do.
4) When pilots are faced with an emergency, frequently their first problem is realizing (or admitting) that it is an EMERGENCY. That is

the first switch that must be thrown. After the pilot accepts that he or she has an emergency, and is FLYING THE AIRPLANE, and has reasonable control, obviously the flight may have become non-standard to some degree or other, depending on conditions, careful evaluation of the situation must then determine the extent of deviation from normal procedures. You must get back on the ground as quickly and as safely as possible, but NEVER exceed your own capabilities. If necessary, declare an emergency, but get an immediate clearance for any runway (if at an airport). You may have to land downwind, or crosswind, whatever. Keep your cool, watch your speed and make as normal a landing as possible, depending on the circumstances.

PREVENTING CARB ICE using a Teflon coated throttle plate, shaft and screws plus a gasoline icing inhibitor.

Long-EZ builder/flyer Ken Clunis sent us a copy of Mechanical Engineering Report LR-536 from the National Research Council of Canada titled "Aircraft Carburetor Icing Studies" by L. Gardner and G. Moon. This report is quite extensive and obviously very carefully researched. The summary of the test results states: "A study has been made of the effects of gasoline icing inhibitors on aircraft carburetor icing. An engine test was developed and used to evaluate various types of icing inhibitors. The results obtained showed that aircraft carburetor icing can be prevented by the inclusion of additives in the gasoline.

The use of a Teflon-coated throttle plate to prevent ice adhesion was studied and found to virtually eliminate any ice formation on the plate. The use of ethylene glycol monomethyl ether (EMGE) at 0.10 to 0.15% by volume in the gasoline and the Teflon-coated plate was shown to prevent both carburetor and fuel system icing".

Ken has followed up on this report and has had his shaft, screws and throttle plate Teflon-coated. He is currently running his Long-EZ with these parts installed and is using Prist "Hy-Flow" (not "Lo-Flow" which is alcohol based and may be hard on your epoxy in the fuel tanks), which he says is the best source of EMGE. He has installed a carburetor temperature gauge and is very pleased with his results so far.

Ken says that he had his carburetor shaft, screws and throttle plate Teflon-coated (black) at:

Durable Release Coaters, Ltd.
4 Finley Road

Bramalea, Ont., L6T 1A9
Canada
416-457-2000

His contact there was Dave Lund, himself a well informed expert on carb icing. There is a $75.00 minimum charge. If enough people wanted to get it done, the price would run about $15.00 for shaft, screws and plate in quantities of 10. We sure appreciate the effort Ken put out to obtain this information. It sounds like an excellent preventive measure that EZ/Defiant pilots may wish to try.

FUEL SELECTOR VALVE UPDATE
In CP 57, we discussed the sticking fuel valve problem which is not a problem to be taken lightly. At least one VariEze has crashed due to a stuck valve and the FAA has contacted us asking us to do something about this problem. The Whitey stainless (or brass) valve is a good valve, uses Teflon seals against a ball, and it turns nice and smoothly. The major disadvantage is the configuration. It is not a bolt in direct replacement. It requires a new mounting bracket and the intake is located on the bottom of the valve, making it more difficult to install.

Yesterday, we saw the best fuel valve we have ever seen. It is a direct, bolt-in replacement for your existing weatherhead valve. It uses the same elbows and nipple in the same orientation but, best of all, it turns smoothly and freely with a very positive spring-loaded ball detent system which lets you feel that you are in the left, the right, or the off position. The handle cannot be installed incorrectly and it is not a tapered plug design which can be prone to sticking. It has a parallel shaped valve body that uses replaceable "o" rings. The whole valve comes apart with two snap rings for easy maintenance. It is made of hard, anodized aluminum and is very light. OK, so what's the catch? The perfect valve, right? Yes, but - Wicks Aircraft will need at least 50 firm orders before they will be able to stock them. They will sell to the homebuilder for $118.65! A lot of money, but then again, what is your life worth? And maybe the life of a loved one or friend? A stuck valve can ruin your day. For $118.65, this problem which has been ongoing for several years now, will be gone forever. If you would like to have one, write or call Wicks and place an order. When Bud Myers has 50 orders, he will get them in stock and this fine fuel valve will, hopefully, eliminate this "sticky" problem once and for all.

FUEL BOOST PUMP UPDATE
CP 57's fuel pump alert caused many letters and phone calls and there still appears to be much confusion.

RAF recommends, as a first choice, a Facet boost pump with 37 degree x 3/8 flare fittings and with a nylon foot valve on the inlet side and a nylon plunger valve on the outlet side. The Facet part numbers for this pump are:
40108 - 12v 6 psi max. 4.5 psi min. 37 degree flare
40154 - 24v 6 psi max. 4.5 psi min. 37 degree flare

If you do not want to install the aircraft style 37 degree x 3/8 flared fitting type pump, due to plumbing requirements or space or whatever, the next best choice would be to use a pump with 1/8 - 27 national pipe thread internal or female threads, requiring elbows such as AN822-6 to go to 37 degree x 3/8 flared fittings.

40106 - 12v 6 psi/4.5 psi, 1/8-27 NPT internal threads.
40082 or 40164 - 24v 6 psi/4.5 psi, 1/8 -27 internal threads.

Facet does not manufacture a 3/8 - 18 internally threaded pump that meets the 6/4.5 psi fuel pressure requirement with nylon valves. For this reason, RAF is not recommending the larger internal thread style pumps. Anyone who is using one of these pumps should be very aware of

the fact that while the outlet plunger valve may be nylon, the intake valve is Buna or rubber and is a check valve, not a foot valve. A check valve will maintain full fuel pressure on your fuel system down stream of the fuel pump and against your needle and seat float valve in the carb. This is not necessary nor is it desirable in any RAF design. If you are using one of these pumps, a careful inspection of the

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intake valve at least once a year is strongly recommended.

Ian Wilde from Olney, England, a Long-EZ builder/flyer, sent this information in and we have included it here to help those builder/flyers of RAF designs in England. "Facet fuel pump, #40108 is not easily obtainable here in England, however, I am told by the Facet agents that #40105 is the replacement for 480615 and that this pump has all nylon parts. (40105 has a maximum fuel pressure of 4.5 psi which should be OK - all the pumps RAF is now recommending have a 6 psi maximum). Price in the UK is 30.00 Sterling. Better still, the plunger assembly of #480615 can be replaced with an all nylon assembly as per #40105 at a cost, including labor, of 10.93 Sterling, including tax and postage. I have had mine modified and I am very happy with it. Anyone interested should contact the Facet agent:

FSE (Fuel System Enterprises)
180 Hersham Road
Hersham
Walton-on-Thames
Surrey, KT12 5QE
Phone: 0932 231973
Telex: 925109 Fuelit

My contact was Mr. Peter Huxley"

FUEL FLOW CHECKS
As called out in CP 53 have caused a number of builders some confusion. We even re-checked our numbers to be sure we had not made a mistake! Mike and Sally's Long-EZ and Burt's Defiant are both relatively old (8 years and 11 years) and the electric fuel boost pumps were also this old at the time of the tests, as were the mechanical fuel pumps.

Since we have installed new Facet electric boost pumps on both of the above aircraft, we also cannot get the fuel flows called out in CP 53. We believe that the foot valve springs in the new pumps must be creating enough restriction to fuel flowing by gravity, that it is impossible to obtain the flow rates called out in CP 53. Of course, the "fuel pump on" tests are still relevant and nothing has changed in this test. We believe, now, that the gravity flow check must be conducted by removing the gascolator bowl or breaking the fuel line at the gascolator. You should be able to achieve the flows shown in CP 53 using this method for the gravity flow check. You should re-connect the fuel line at the gascolator for the "fuel pump on" test and break the fuel line at the carburetor. Again, you should be able to achieve the flows shown in CP 53. If you cannot get at least the correct flows shown, you may have a restriction in the fuel lines or fuel valve. This restriction must be cleared before flight.

LONG-EZ AILERON BELHORN FAILURE

RAF has recently received two separate reports of failures of one of the CS132L weldments, the belhorn, which drives the aileron out in the wing roots. One of these belhorns has had lightening holes bored through the .050 steel belhorn and it cracked through one of these holes. However, the second one was as received from Brock and it cracked across at the edge of the weld around the tube. Prior to the failure of the belhorn this builder pilot had had to replace the rod end that bolts to this belhorn, at least twice over the past 350 flight hours, due to the rod end being "pounded out" until it was dangerously loose.

The belhorn failure occurred in flight and caused a few moments of concern, but in both cases the Long-EZ was easily controlled. A disconnected aileron will float trailing edge up. To keep the wings level, the pilot has to raise the trailing edge of the operable aileron which, of course, will give a nose up pitching moment requiring forward stick to fly level. The one operable aileron will provide reasonable roll control and, of course, the rudders will roll the airplane by themselves. The greatest hazard would be if the disconnected aileron pushrod, being loose in the cowling/root of the wing area, ever managed to get itself jammed. Depending how much lateral input there was at the time, you may or may not be able to correct the roll with rudder.

A primary control system failure is cause for strong concern so we at RAF have designed,

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built and flight tested a new aileron belhorn. Drawings for this new part have been sent to Ken Brock Mfg. and Ken will have these parts available as soon as possible. We will provide a drawing of the new belhorn in this CP for those people who would like to make these parts themselves. (see sketch, page 15) **SKETCH OMITTED**

Why would this belhorn fail on two relatively low time Long-EZs when we have literally dozens of Long-EZs with 1000-plus hours and some with 1500-plus hours with no failures and zero wear on the rod ends? Bill Freeman, Long-EZ builder/flyer and a man whose specialty is working with vibration problems and who has a Master's degree in Mechanical Engineering, has a theory with which we concur. The original control system with aluminum push rod tubes apparently was OK. The natural frequency of this collection of parts was not the same as the normal cruise excitation frequency of the engine/prop. Changing the aluminum tubes to steel as called out in the CP may have moved the control system into the excitation frequency of the engine/prop combination. Bill says that this strongly suggests to him a spanwise vibration of the CS132L belhorn and CS129L pushrod at, or near, its natural frequency, inducing a high-cycle fatigue failure in the CS132L belhorn. The fact that the rod end bearings were beaten out is strongly suggestive of a resonant vibration of the CS132L and CS129L pushrod. This vibration would have the bottom end of CS132L and the aft end of CS129L moving spanwise, bending CS132L in the weak direction with high enough stress levels to initiate a fatigue failure in CS132L.

The new part, part number CS132L-R, has two arms instead of one which will more than quadruple the stiffness of the system and will also provide redundant links in the aileron system as well as providing positive retention of the rod end in the event of a ball slipping out.

If you absolutely insist on flying before the new belhorn is replaced, a careful examination of your CS132L belhorns are mandatory. Use a bright light and a magnifying glass. Examine the area shown in the sketch while gently flexing the CS132L left and right. Any sign of a crack starting requires immediate grounding of the aircraft until the new CS132L-R is installed. Examine the rod ends bolted to the CS132L. Look for a loose ball, or play in the rod end in the fore/aft plane. A worn rod end must be replaced before flight and you should realize from the above discussion that a worn rod end almost certainly indicates that a belhorn failure is imminent. If you have steel tube push rods (CS132L), your belhorns are definitely more suspect. If you have worn rod ends, do not fly until you replace the belhorns and rod ends. Even if everything looks OK, replace belhorns within the next 25 hours of flight. The CAD plated CS132L belhorns should not be painted since the paint may hide a crack.

This is a serious matter and should not be ignored. A primary control system failure could result in a serious accident.

Please report any cracked or broken belhorns to RAF along with the number of hours on the airplane, whether you have aluminum or steel push rod tubes and if you have experienced rod end wear or failure.

AILERON VIBRATION
Below is an excerpt of a letter received at RAF recently.

"Thanks for all the good newsletters. Just to clarify, I have had aileron flutter (see Ed. note). At 10 hours, I noted a lot of aluminum dust behind the aileron hinges. In flight, I visually could see the tip of both ailerons as a 1/4" blur. I added leading edge weight and installed the Teflon hinge pin setup. At this point, I had no visible vibration at 2000 ft at 120 mph, but still had vibration at 8000 ft., 160 mph. It remained this way for many hours of "hauling rides" but less than 5 cross country hours. Note: I never was able to detect any vibration on the stick.

I recently put more weight on the right aileron which was still vibrating slightly at altitude. This extra weight was along the outboard end where I had previously not had any. This

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finally cured the problem. Now the ailerons hang with the top surface level. Note: The problem occurred when the ailerons balanced bottom surface level as per plans. Note: Both ailerons had this problem. The left aileron is very accurate dimensionally, the right's trailing edge rises 1/4" in the outboard 8" from a straight line. Also, I have a good surface finish, laminar flow, as evidenced by wing drop before the vortilons.

It is very hard to see the trailing edge of the aileron and difficult to decide if it is indeed vibrating 1/4" or if your eye is just not that sharp, but having fixed it, I can verify that it was not an optical illusion.

I feel that many Long-EZ's probably have this problem and their pilots are not aware of it. Again, there is no indication of stick vibration.

Larry Bush"

EDITOR'S COMMENT
We have published Larry's letter as he wrote it because we believe he experienced the same phenomena described above: Engine/prop excited "forced vibration" driving his aileron at the same frequency as the engine/prop. "Flutter" is an aerodynamic condition and is normally divergent, i.e., expands to destruction. "Forced vibration" can continue as long as the source (engine/prop) is maintained near the same frequency as the natural frequency of the aileron. By over-balancing his ailerons to the top limit as called out in the plans, he has (1) changed the mass of his ailerons thereby lowering the natural frequency of the ailerons and, (2) repositioned the CG of the aileron relative to the hinge, thus reducing the "forced vibration" input.

If your ailerons are vibrating at the trailing edge as Larry's were, you must add more leading edge weight. Note: We checked several Long-EZs here at Mojave and none of them exhibited any visible vibration at the trailing edge, however, all of them show some signs of aileron hinge wear (black aluminum dust on the aileron, particularly after flying through moisture).

Keep in mind that it may be difficult to spot. Have a passenger in the rear seat look at the aileron trailing edges very, very carefully. Spend at least 30 seconds staring at the ailerons in level flight, in a climb, in a descent, and in left and right turns. If any vibration is seen, re-balance the ailerons.

The easiest way is to get some lead ribbon from a golf pro shop and stick it to the top of the aileron leading edges, full span, until it balances top skin level. Lay up one ply of BID to permanently secure the lead to the aileron leading edge. (see sketch, page 15). **SKETCH OMITTED**

We would like to thank Larry Bush for the excellent feedback on this situation. This is the kind of information we all need to know about in order to keep the large fleet of EZs flying safely and consistently.

PLANS CHANGES
We at RAF, of course, cannot enforce a mandatory change as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory - ground the aircraft. Do not fly until the change has been accomplished.

MAN-XXHR	Mandatory - accomplish the change at next convenient maintenance interval or within XX flight hours, whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not affect flight safety.

MAN-GRD: Long-EZ and VariEze - see section on belhorn failure. Replace aileron belhorns within the next 25 hours of flight. If ailerons are vibrating, you must re-balance.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

SHOPPING

WICKS AIRCRAFT SUPPLY
Wicks has Neoprene and fiberglass baffle material in stock, Part #CCM36. This is an excellent material to seal the gap between the aluminum baffles and cowling.

"The best fuel valve we have ever seen", will be in stock at Wicks soon. Part #6S122. It is a direct, bolt in replacement for your VariEze, Long-EZ or Defiant, and it is all "O" ring seals (replaceable) with a very positive spring and ball detent system. Place your order with:

Wicks Aircraft Supply
410 Pine Street
Highland, IL 62249
818-654-2191

DIGITAL TACHOMETER. In the past, we at RAF have not been too impressed with digital tach's, however, the current lack of a really accurate

analog tach has prompted us to look at this situation again. The Braal Tach 1 is tiny, (1.2 x 2.17 x 2.67 deep) but easy to read. A digital tach which is accurate to plus or minus 2 rpm! It only weighs 8 ounces and uses an infrared sensor (optical reflective switch). This must be cleaned once a year. It is easy to install. It comes with sample rates of 1/2 second, 1 second, and 2 seconds which allows you to choose a tach to suit your needs. Probably the 1 second would be best for use in an aircraft such as an EZ. Very accurate leaning can be achieved with a tach as accurate as this, but if super economy is your bag, the 1/2 second tach might be the best choice.

For Lycoming installations, the installation kit includes bracketry to mount the optical sensor. For Continental powered EZs, you will have to build your own simple mounting bracket. The manufacturer recommends an internally lighted tach if you intend to mount it down low or horizontally on a console. We recommend you mount it as a "head's up" display as high as possible in your panel. For this, you can get away with a non lighted tach. Prices range from $165.00, non-lighted, to $190.00 for the internally lighted model. Both models have a one year warranty on parts and labor. For more information contact:

Braal Micro Instruments, Inc.
160 Eastman Lane
Petaluma, CA 94952
707-763-9377

AEROGRAPHICS
Number 1 in aircraft lettering. We agree! The service is great, next day or overnight delivery is available on lettering or "N" numbers in 50 different styles in sizes from 1/4" to 24" tall in every color imaginable.

Call, toll free, to place an order or if you just have questions. We used Aerographics on Catbird and Scaled Composites' new mini business jet. The "N" numbers look beautiful

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and are easy to install and are as thin as paint. Call:
1-800-336-9633.

LONGER POT LIFE FOR STERLING PRIMER FILLER.
Nat Puffer, VariEze builder and COZY designer/builder, reported to us that Wicks Aircraft will be stocking a new catalyst for U1761 Sterling Primer. Sterling makes an excellent urethane primer but in the past, it has been a material that many builders have found develops pinholes! By the hundreds! Pinholes! Also, the pot life has been very short, making it difficult to spray and clean you gun out in time. Well, Nat assures us that using the new catalyst U-1000C, the pot life is almost 6 hours and virtually eliminates pinholes. U-1000C is available in quarts as wells as gallons. Thanks, Nat.

VOYAGER - THE WORLD FLIGHT
The Official Log, Flight Analysis and Narrative Explanation by Jack Norris. Comes three ways, Regular copy, $12.95 (exactly as on file in the official records and archives). Autographed copy, $15.00

(personally signed by Dick and Jeana). Personalized gift copy, $20.00 with your name written, a thanks and autographs by Dick and Jeana.

This log contains every detail of "how and why" the Voyager flew around the world on one tank of fuel, written by the technical director in Voyager Mission Control. Contact:
Jack Norris.
PO Box 7663
Northridge, CA 91327
818-360-1105

CANARD PUSHER INDEX
"Response to Canard Pusher Index that was discussed in CP57 was much greater than I had expected! All orders have now been shipped and I have a good number of Digest copies ready for immediate delivery.

After a long period of deliberation, I've decided to publish quarterly updates to the Canard Pusher Digest. Compiling the Digest set me nearly a year and a half behind on my own Long-EZ project, and I was initially hesitant in taking on the task of compiling updates - a task which will no doubt put me even further behind. However, nearly all of you who ordered the Digest expressed a desire for the updates, so I feel somewhat obligated to make them available. Updates will be compiled so that the new information can be inserted at the front of each affected Digest chapter.

Effective 15 February, all new orders for the Canard Pusher Digest will include Update number 57. Update 57 contains information from CP57 necessary to update the basic Digest package. Also effective 15 February, the cost of the Digest will be $53.00, plus $4.00 shipping. This cost increase is necessary to cover the additional cost of the update.

Yearly subscriptions for the Digest Updates will be $30.00. Updates will be mailed to subscribers 4 times per year, each within a month of receipt of the respective CP newsletter. I apologize for the high cost, but copy costs these days are unbelievably high, and I'm unable to get volume discounts due to the relatively low number of copies required. In addition, there usually will be many more pages in the update than the CP from which the information was obtained. This is because many CP articles affect more than one Digest chapter and have to be duplicated for each chapter affected. As an example, Update 57 contains 44 pages, more than double that of CP57.

Stet Elliott
Building 12-1-2
Governors Island, NY 10004
212-825-0011"

EDITOR'S COMMENT
If you have not seen the Canard Pusher Index, you are missing a bet. It is great. We use ours almost every day and we have heard from a number of builders who feel the same way. Give Stet a call.

DEFIANT INFORMATION
An excellent source of Defiant information from builder hints to pilot reports. Contact:

Charles Sims
1918 Atlanta
Deer Park, Texas 77536
713-476-5406 (H)
713-930-1133 (W)

The Texas Defiant Newsletter is a steal at $10.00 per year and Charlie has all of the back issues available for $60.00. As Charlie Sims says, "This newsletter is about builders helping builders. It is not a profitable newsletter but is intended as an exchange of information by communication".

MAGNETO COVER SCREWS
Ever tried to remove the mag covers on an EZ? 90 degree screwdrivers, skinned knuckles, one or two hours of cussing and, finally, you get 'em off. Right? If you have been there, you will love these Allen screws - direct replacements - uses an Allen wrench - remove all six screws in one minute. Send $1.00 and SASE for 6 screws to:
Mike Melvill
Bldg. 13 - Airport
Mojave, CA 93501

FOR SALE

Lycoming 0-235-L2C. 600 SMOH in my Long-EZ, 125 hp, "F" pistons, exhaust system, prop extension, prop, spinner, oil cooler, baffling, vacuum pump, B&C 35 amp alternator. $5900.00 Contact:
Gus Sabo
2842 Brockington Dr.
Las Vegas, NV 89120
720-454-0078

Lycoming 0-235 Zero SMOH. Set up for Long-EZ $4600.00. Many other Long-EZ parts. Contact:
Edwin F. Goad
CCNP PO Box 786
Pinehurst, NC 28374
919-692-3813

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62 x 62 Great American Prop for Lycoming 0-235/115 hp. For Long-EZ. Leading edge protection, SAE 1 flange, like new - used only 25 hours. $450.00 plus shipping. Contact:
Mike Stolle
9505 Candle Lane, NE
Albuquerque, NM 87111
505-821-3778 (H)
505-844-0321 (W)

Exhaust system by Sport Flight for Lycoming/Long-EZ Contact:
John Hayes
2505 Liston Lane
Euless, TX 76039

817-294-0975 (H)
817-267-2771 (W)

Whelan Power Supply, Par #A413A HDA DF, 14 volt. Factory tagged 1-89. $140.00

12 volt, DC, Quartz cabin Heater. $60.00 Contact:
Steve Franseen
10196 W. Keene Ave.
Denver, CO 80235
303-534-8181

Accessory housing - Lycoming 0-235-L2C, PN GW16011. Cleaned - machined for fuel pump and checked. Tagged 7-2-88. $255.00 Contact:
Ray Ratzlaff
Hangar 13
Mojave, CA 93501
805-824-4976

Accessory case for Lycoming 0-235 machined for fuel pump - $75.00

Oil cooler adapter - $25.00.

Oil pump housing and gears - $15.00. Contact:
Marc Borom
2171 Foxhill Dr.
Schenectady, NY 12309
518-370-2662

WANTED
Small wheel pants suitable for Long-EZ with Lamb tires - maybe you have changed to 500 x 5 tires and have a surplus set? Contact:
Glen Fleming
105 Van Dyk Court
Lafayette, LA 70503
318-984-8871

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

The Airplane Factory
8300 Dayton Road
Fairborn, Ohio 45324
513-864-5607

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

ACCIDENTS AND INCIDENTS

A California VariEze suffered an engine failure over the airport and crash landed short of the runway in two to three feet of water. The airplane flipped over and the pilot did not survive. The FAA has stated that their initial findings are that carb ice was probably the cause.

This was carefully looked into by people much more expert in these matters than we here at RAF, and their report to us was that, yes, they would have to agree with the FAA. The weather was conducive to induction icing with light rain, fog and high humidity. This pilot was in the process of fine-tuning his EZ with the intention of entering it in the CAFE 400 efficiency race. With this in mind, he was after fuel efficiency at medium power setting. He made a number of improvements to his Continental 0-200 engine but one of these changes was probably very significant in light of the accident. He altered the intake manifold to include an expansion chamber, or plenum, downstream of the carburetor or, in this case, a throttle body. While throttle body types, in general, are highly resistant to carb ice, it is strongly suspected that the induction ice in this case probably formed in the plenum downstream of the throttle body. Tests have shown that allowing the fuel/air mixture to rapidly expand after it comes out of a venturi, or throttle body, can cause immediate and severe induction icing in the plenum and intake tubes, yet not form any ice in the carburetor or throttle body.

In view of the situation, this is very likely what happened. The builder/pilot had been experiencing power related problems since installing the new plenum-type intake manifold and had, in fact, been working on a carb heat system. He arrived over head the destination airport and reported having lost power. Visibility was poor, but he was seen on short final, gliding toward the runway threshold. Tragically, he was about 50 yards short and touched down in 2 to 3 feet of water on the extended runway centerline. The EZ pitched nose down and flipped on its back where it remained until rescuers lifted it out of the water. The plexiglass canopy was broken, the canopy frame was undamaged as were the latches and hinges. The canard failed aft on both sides, leaving a short center section of the canard still attached to the fuselage. Left and right pieces of the canard from the fuselage sides out were torn off. The fuselage was damaged below and aft of the canard. The wings and winglets were not damaged. After drying out the engine, it started and ran OK although a magneto was replaced due to waterlogging.

What can we learn from this tragedy? The pilot was unable to exit the airplane, either because it was inverted with its nose and canopy imbedded in the mud on the bottom of the shallow bay, or because he may have been incapacitated by the impact, or both. Obviously, this situation was very bad and the chances of surviving a crash landing in shallow water are very slim. Since this accident, RAF has received a number of calls and letters wanting to know how to ditch an

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EZ. We honestly do not know of a safe way to ditch any fixed gear airplane. The possibility of nosing over is very high with fixed gear since the gear dragging in the water produces a powerful nose down pitching moment.

If we were faced with an unavoidable water landing, we would put the nose gear and landing brake down and we would fly into the water as slowly as possible while still maintaining control. We would not unlock the canopy because when the nose dives under water, a 60 mph jet of water entering under the canopy and striking the pilot in the face, would almost certainly be incapacitating. We would recommend carrying a canopy breaking tool such as a heavy, short bladed knife, kept where the pilot could easily reach it. After the airplane has come to rest, be it upright or inverted, if the canopy was intact, the canopy breaking tool should be used to break the plexiglass, making a large enough hole to exit through. Since an EZ will almost certainly float, particularly if it remains mostly intact, the surface would not be far away.

Prior to touch down, declare an emergency and, if possible, give an accurate position report. (A Loran would sure be handy here, since you could broadcast your latitude and longitude position.) Tighten your seat belt and shoulder harness as tight as you can bear it and brace yourself as best you can. Try for the slowest controlled touch down, no fancy stalling maneuvers, these will usually only compound the problem. Since the EZ-types will almost certainly nose over, be prepared for this. Remain calm, release your seatbelt, break out and swim to the surface.

Better yet, since a successful water landing is so uncertain, perhaps we should all seriously consider remaining within gliding distance of land at all times. EZ's were never designed with landing in water as one of the goals, and they are almost certainly not at all suited for this activity.

One other VariEze crash landed in water. The cockpit area broke up and the pilot found himself swimming. He made it to the beach but had a fractured back and wound up in a body cast for two months. His EZ was severely damaged and he never did rebuild it.

Surprisingly, or perhaps not surprisingly, one of the phone calls we got suggested we, or someone, should conduct a test by deliberately crash landing an EZ, preferably by remote control, in water!

CAN YOU HELP?
A Kansas City pilot traveled to the Grand Rapids area of Michigan where he purchased a VariEze. With no check out or weather briefing, he took off and headed for home. He landed at Peoria, Illinois for fuel. An attempt was made to repair a small gas leak in one of his fuel sight gauges before departing for Kansas City. The pilot then took off into what eye witnesses have called "marginal VFR conditions" with heavy rain, thunderstorms with tops to 41000 feet, turbulence and icing conditions reported up to 6000 feet. His last known position was 20 miles southwest of the Peoria airport. The pilot did not arrive at his destination, nor has anyone see or heard from him. His wife has been

working very hard with FAA and CAP and the CAP conducted an intense search of the area for almost three weeks. Initially, the search was conducted with no snow on the ground and with good visibility, but with no sign of the VariEze.

This pilot's wife is determined to try to find her husband and has asked Burt to help in any way he can. We would ask any of you who may be in this general area, that is on a line from Peoria to Kansas City, to assist in the search. Keep in mind that a VariEze is tiny. If an EZ crashed into a wooded or brush covered area, it may not even look like a VariEze any longer. If you are flying over this area, look for anything white, not necessarily the shape of a VariEze, and please report anything to the CAP in Kansas City (phone 618-256-4815) or, if anyone knows of this VariEze, N234EZ, having landed somewhere else, please contact Mrs. Jo Ann Wilson, phone 913-888-5023.

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VARIOUS SKETCHES OMITTED

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 59.
VariViggen (2nd Edition), newsletter 18 to 59.
VariEze (1st Edition), newsletters 10 thru 59.
VariEze (2nd Edition), newsletters 16 thru 59.
Long-EZ, newsletters 24 through 59.
Solitaire, newsletters 37 through 59.
Defiant, newsletters 41 through 59.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 AM TO 5:00 PM ONLY. If you have parts that you would like us to see and/or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come other than those days, please call so we will be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please give your name and serial number. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. If you are placing an order, it's best to keep it separate from a request for an answer.

RAF ACTIVITIES

As many of you know, Rutan Aircraft has been sued by an English Company, Aviation Composites.

In 1982, RAF was contracted by Colin Chapman of Lotus Cars, Ltd. to design and build a microlite aircraft. A proof of concept aircraft was built and a basic flight test program was conducted. No problems were found with regard to its stall characteristics.

Aviation Composites employed VariEze builder, Ivan Shaw, and built a similar but much heavier version and had several problems with it.

Aviation Composites approached Scaled Composites requesting developmental help. While we were assisting Shaw with flight testing, we discovered a poor spin recovery characteristic. (See CP55, pg 5).

Aviation Composites next step, of course, should have been to equip the aircraft with a spin recovery parachute and to develop an appropriate aerodynamic fix for the problem. Instead, they discontinued support of the flight testing and sued RAF for all of their expenses to date, allegedly amounting to several million dollars.

This situation, win or lose, of course, poses a serious threat to RAF's financial ability to continue to provide builder support. We will keep you informed of developments in future CP's.

NORM HOWELL DOES IT AGAIN!

A new world record - this time in a very light Long-EZ, N9TS, borrowed from his friend, Terry Schubert, of Cleveland, Ohio.

The C1-A (altitude record), (1102 lbs. max. take-off weight) now belongs to Norm. He took-off at 1101 lbs.!, climbed to 25,000 feet, establishing a new altitude record for this weight class. The entire flight lasted only 55 minutes. Norm has put together a really neat oxygen system using a full face military mask and says it worked great for this flight.

Congratulations, Norm. What will be next? Norm already owns several speed/distance records in his Quickie, the "Ugly Quickling".

FLY-INS

Shirl and Diane Dickey have organized no less than three (3) fly-ins this year. (What a go-getting couple this is!). The first of these fly-ins is at Kanab, Utah on May 27th, 28th and 29th, 1989. Shirl will have the usual race schedule (similar to Jackpot and Wendover) which will start at 8AM Sunday 5-28-89. Camping is encouraged and a steak fry will begin at 7PM that evening. Contact:

Shirl or Diane Dickey
1702 W. McNair
Chandler, AZ 85224
602-491-1548.

#2 - 7th Annual Jackpot 125 Proficiency Run.
Jackpot, Nevada, July 1 2, 3, and 4. Come join the fun at Cactus Pete's Casino on the airport at Jackpot, NV. Prize money will be paid from 1st to 5th place in each category. There will be a dinner show (featuring Glen Campbell!) Saturday night. A ribbon cutting contest Sunday morning, plus a spot landing contest. What more could you want? This is the fly-in of the year and is not to be missed. Contact Shirl or Diane for details or call Cactus Pete's Casino at 1-800-821-1103.

#3 - 4th Annual Bonneville 120 Fly-In and Air Race. Held at Wendover, Nevada. Lodging at the Stateline Hotel and Casino - advance reservations required. Call 1-800-648-9668.
Similar to the Jackpot 125, the Bonneville is an even faster course, from Wendover Airport across the Bonneville salt flats and back. Dinner and shows, live entertainment after dinner, spot landing contest, poolside cocktail hour and awards presentation dinner. A really historic speed center. The casino has a lot of Bonneville salt flats memorabilia and this weekend event is a place to be if you are interested in speed and fun and you fly your own homebuilt composite airplane. Don't miss out - reserve early. Contact Shirl and Diane for details.

LONG-EZ 84
ABOVE AND BEYOND THE OUTBACK

"While the Northern Hemisphere braced for winter weather, the folks Down Under were busy celebrating their Bicentennial Year and the promise of Summer. Among the many and varied events which commemorated Australia's Bicentennial Year was an Air Race unlike any other ever run in Australia. It's fitting that an air race should have been part of Australia's celebrations as aviation has played such an important part in Australia's pioneering growth. The vast distances and remoteness which are such a part of Australia make aviation a vital part of life in the land Down Under. Without the airplane, the prosperity and well being of Australia would not be what it is today.

The "Aviation Event of the Decade", as one newspaper called it, was actually known as the GE Bicentennial Around Australia Air Race. Sponsored by General Electric (USA), the race lived up to its name as it covered more than 6100 nautical miles and virtually circled Australia. More than an air race, it was a "Bicentennial Event" which brought the celebrations to remote places and people in the vast Outback of Australia, as well as to its capital cities.

105 competitors took the starters flag in Narromine, New South Wales for the first race leg to Toowoomba, Queensland. The lineup was quite a spectacle as military and civilian single and multi-engine aircraft taxied into line to await their flag-off. Among the competitors were some noteworthy vintage aircraft and four homebuilts; a Thorp T-18, two Long-EZs, and a VariEze. The highest finishing of these was Long-EZ '84', built and piloted by Queensland businessman Magna Liset. His copilot and navigator was Wayne P. Johnson, a US Army Captain and Flight Instructor on exchange to to the Australian Army Aviation Centre in Magna's hometown of Oakey, Queensland.

Long-EZ 84 crossed the finish line at Rockhampton to capture ninth place at the end of the first day's racing. It was an indication of the aircraft's true potential. 84's aircrew had decided to restrict maximum rated power to climb only, thereafter throttling back to

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75% power to conserve the engine and ascertain if the aircraft would be competitive. It became very clear from the outset that this would be a long race, one in which the fleet of wing might not necessarily be the

victor. Speed and endurance were to be critical elements of any winning combination.

Second day's race leg was somewhat shorter, run from the coastal plains of Rockhampton to the dry inland cattle ranching area of Longreach, home of the "Stockman's Hall of Fame". Over this leg, Long-EZ 84 managed a higher average speed than in the previous leg and secured fourth place for the effort. This was partially due to guessing the winds aloft better than some of the competitors, and to the use of a ram-air plenum which had been fitted to the aircraft prior to the race. The newly fitted ram air system was good for an additional 50-125 RPM in cruise flight. The resultant difference in true airspeed can easily be appreciated.

The departure from Longreach early on the morning of the third day wasn't without some drama. A crack was discovered in the prop spinner during last minute preparations and a decision was made to stop-drill it until more permanent repairs could be made. These were planned for the end of the day at Alice Springs, where we hoped time and resources would allow such an effort. Unfortunately the vibration generated by running the engine at continuous high RPM made the crack worse, as was evidenced by its singing in the navigator's ear during cruise flight. As it turned out, there was an unexpected delay during the intermediate stop at Mount Isa. The copilot-navigator donned his A&P hat and raced off to find an FBO equipped to make airframe repairs. Spinner repaired and polished, Long-EZ 84 sat in the 38 degree C mid-day sun awaiting its starting time. Long-EZ 84 crossed the finish line at Alice Springs late in the afternoon with what its crew felt would be a good performance. The aircraft had flown predominantly low-level over the longest the most remote race leg of the entire event, using thermals enroute to enhance true airspeed. This was possible because the winds aloft were forecast as either headwinds or crosswinds. Given the aircraft's rather sluggish climb performance, but excellent cruise and turbulence penetration, it was decided to gamble on a low level leg with an accent on precise great circle navigation. The ride for the "guy in back" wasn't conducive to the stubby pencil routine or computing, but the pilot accurately flew the directed headings and courses and '84' maintained its great circle route within one-quarter mile throughout the entire leg. The Race Director's announcement that M. Liset in Long-EZ 84 had won the Longreach to Alice Springs leg was its crew's first indication that they were truly in the running. It had been a good day! The first of several.

Analysis of aircraft climb and cruise performance during the first three days convinced both navigator and pilot that the contest would effectively be over once the high performance twins, especially the Royal Australian Air Force's entries, reached conditions favoring higher altitude cruise performance. The winds aloft during the timeframe of the air race were predominantly westerlies and northwesterlies. Obviously, an aircraft with good low-level performance, accurately flown along its shortest route, would fair much better than a high performance aircraft better suited to upper-level cruising.

Long-EZ 84 made the most of its 'tactical advantage', winning the fourth leg from Alice Springs to Darwin, as well as the fifth and sixth legs from Darwin to Broome and Broome and Canarvon. This run of

success put the little homebuilt into second place as the fleet reached Perth, only 20.42 points behind the Ted Smith Aerostar 601P of Ted Rear. By the time the race reached Perth, it was a National event with considerable attention from the news media. While Perth Businessman Ted Rear enjoyed the attention of his hometown press, Magna Liset and the 'Unusual tail-first homemade airplane from Queensland", weren't short of curious onlookers, well wishers, and radio and TV commentators. In fact, by the time it reached Perth, anyone remotely interested in the air race knew about the little plastic airplane built by some fella from Queensland. What's more, they wanted to see and touch it for themselves. All of this instant notoriety, although flattering, was a little troublesome at times. Everyone wanted to leave fingerprints all over the canopy. The navigator spent most of his time rescuing

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Magna from the upteen thousandth redundant question or (re)polishing the canopy. About two hours of this and your fun meter was just about pegged out!

As predicted, once the race turned eastward and tailwinds became the order of the day, the big boys got on with it and left the less well endowed struggling to catch up. Long-EZ was now hard pressed to hold its own and, in fact, lost ground slowly. It was very disappointing to watch the ground speed figures, knowing that the big guns were doing much better at higher altitudes, and had been doing so longer. Add the fact that as the day wore on, the winds aloft typically lost intensity. All of which meant that the early birds definitely got the best worms.

It turns out that Long-EZ 84's left magneto developed a 'leak' while crossing the Nullabor Plains. The crew thought that the hard full-power running at low altitudes prior to Perth had taken a toll on the rings and valves, which accounted for the noticeable, but then unexplained loss of revs. The magneto problem was only confirmed after the race..

When all was said and done, Long-EZ 84 wound up capturing the 3rd place prize, good for $4,000.00. Or as Magna put it, "This air race stuff is okay!"

You may be wondering how the race was run. Funny you should ask. The navigator asked the pilot the same question, and spent the first two days figuring out the answer. Simply put, it was a handicap race based upon manufacturers' design specifications and 75% cruise performance. The resultant calculations yielded each competitor's handicap True Air Speed (TAS). Each day the Race Director would announce the handicap winds aloft figures used by the timing and scoring section; generally a question of worst or best case from actual area forecasts. It was then up to the individual competitor to achieve the best ground speed (shortest time interval) given their handicap TAS corrected for the handicap winds aloft forecast. To keep the race within the reach of all competitors, altitude was limited to 10,000 ft AMSL. Competitors seemed to honor this restriction, although there were unconfirmed reports of some of the high flyers and fast movers sneaking above the mark to 'have a look'.

Long-EZ 84 represented the breed very well. It's average TAS was 161.64 Kts. The highest recorded TAS was 170.39 Kts. The highest recorded groundspeed was 251.76 Kts, achieved while crossing the Nullabor at 10,000 ft AMSL between Forrest and Ceduna. Bear in mind that the aircraft consistently took off with the highest all up weight of the two Long-EZs in the race. Fuel capacity was never a problem; however, the very long distances of some of the legs, combined with rather stringent VFR fuel reserve requirements in Australia, made for a heavy aircraft on occasion. This was particularly evident in climb performance, especially since the aircraft was fitted with a Great American Propeller Company cruise prop. On one of the legs, an unexplained loss of TAS and groundspeed became evident as the flight progressed. Engine instruments said everything was operating at full potential but the navigator's computer said .04 Kts slower than anticipated. The culprit turned out to be a thin coating of salt brine on the aircraft's surfaces which effectively gave it a fine sandpaper finish. Washed and rewaxed, the elusive knot found its way back to the airspeed indicator. Smiles all 'round! The Lycoming 0-235 engine was run at 2,900 RPM during cruise flight with ram air applied. Descents were made at Vne with the actual descent point/gradient dependent upon the known and forecast winds aloft. Let's just say that Long-EZ 84 made an impressive finish at the end of each leg, as witnessed by many spectators on the ground. From the back seat, it sounded quite spectacular to hear the engine at full chat on the downhill slide. The old prop really sings!

In essence, the GE Bicentennial Around Australia Air Race was just that - a race. Those competitors who were serious about racing and winning had to push themselves and their aircraft. In the final analysis, it was the optimized integration of man and machine which spelled the difference between success and "also ran". Anyone who came thinking they could 'cruise' around Australia and do well just didn't understand the problem. Long-EZ 84's success was the culmination of much hard work by a man who spent five years of his life building a dream. The aircraft is one of the finest aerodynamic

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examples you'll find anywhere. The pilot flew the aircraft to its potential, and the navigator kept it on track along carefully plotted great circle routes. One of the critical keys to success was the aircrew's use of very accurate 1:250,000 JOG-AIR maps. Although this meant considerable map preparation prior to each leg, and 131 map sheets at the start of the race, the navigational accuracy and appreciation of winds aloft and groundspeed made the result well worth the effort. There were times when the navigator was planning until 2:20 AM and getting two hours sleep prior to wake-up call. Likewise, the pilot spent his rest days checking, double checking and cleaning the aircraft for the next day's competition. The reward was to get within 20.42 points of leading the air race overall, and earning third prize in the end.

History will record that an aircraft designed by an American named Burt Rutan, built and piloted by Magna Liset and navigated by a United States Army Exchange Officer came within a stone's throw of leading the

most prestigious air race in Australia's history. It came home third and made a lot of people very proud. It generated a lot of interest and excitement and put the homebuilt crowd in the spotlight. and it surprised a lot of people with their very expensive single and multi-engined aircraft.

In most forms of human endeavor, there is some element of that stuff called luck. One competitor was overheard in Perth as he observed how "lucky that Liset chap is." A friend of Magna's caught the comment and added, "Yeah mate, and the harder he works, the luckier he gets." It's refreshing to hear people who appreciate that building an aircraft is no small task. Doing it well deserves respect, if not admiration. It was one helluva air race. You should've been there!"

by Wayne P. Johnson

REMOTE MOUNTED SPIN ON OIL FILTER

Many builders have inquired about such a device and, in fact, several builders have built their own system. Lycoming has the parts necessary to accomplish this but they are incredibly expensive. Long-EZ builder, Mel Hinson (N160EZ), has purchased the tooling to build the adaptors that bolt directly to the accessory case in place of the oil screen housing and your present Vernitherm valve will screw right into this adaptor. These remote filter adaptors will fit all 0-235, 0-320, 0-360 and 0-540 engines. In addition, Mel has tracked down the remote filter mount (a Cessna part) and he plans to make these two parts available for around $180.00. You will have to provide the AN fittings (elbow, nipples, etc.), the high pressure hose (Stratoflex is best), the Vernitherm valve, and the gaskets.

This will give you a remote spin on oil filter (adaptor uses an approved Champion aircraft filter) built from approved aircraft parts with built in bypass valve and will allow 50 hours between oil changes and should extend the life of your engine. For more information or to place an order, call or write Mel. He is presently flying one on his Long-EZ. Contact:

Mel Hinson
Rt 20 Box 316
San Antonio, TX 7821
512-828-0551 (H)
512-651-5086 (W)

THE BUNGEE ELEVATOR TRIM SYSTEM ON AN EZ.

This is an area that has generated a lot of questions and this will be an attempt to help answer many of those questions and, hopefully, give everyone a better insight into the EZ bungee pitch trim. First of all, all that follows here assumes you have built your airplane reasonably accurately - that canard incidence is correct and that wing incidence and relative wing incidence is correct. These items can greatly influence elevator's position and will effect the bungee trim system's ability to trim.

The elevator shape is critical to the success of this bungee spring-operated pitch trim system. If the elevator is the "perfect" shape, it

will float in a faired position relative to the canard at approximately 120 to 130 KIAS, without the springs. This means that at this speed, the aircraft will fly hands off and maintain level flight, even if the springs are disconnected and removed. This is about

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optimum and not everyone will have this situation. If you do, it will then be possible to pick a pair of springs that will provide you with enough spring power to trim the plane hands off down to the approach speed (approx. 65 KIAS), as well as to trim hands off up to the maximum level flight speed. This is normal and perfectly acceptable. Now, if you go faster (by descending, for example, you may run out of forward trim and may have to provide this force by maintaining forward pressure on the stick. Again, for an EZ, this is normal and nothing to be worried about. At the same time, you will probably have to "help" the trim system by maintaining back pressure on the stick as you approach a stall or reach full aft stick. This, also, is normal for an EZ and many other planes.

The problem is when your elevator shape causes your elevator to float, no springs, at, say, 80 KIAS or at, say, 160 KIAS. Obviously, if either of these cases applies to your aircraft, your elevator shape is not correct and you will probably not be able to come up with a pair of springs that can provide enough range to cope with as low as 65 KIAS or as high as, say 170 KIAS (max. level speed). This is because the elevator is trying to fly to a different position than the one you need it to be in for the speed you are indicating. If you put a strong enough spring into the system, you may be able to overcome the elevator's lift and force it to a position it does not want to be, however, this is a losing proposition for two reasons. You almost certainly will not be able to trim hands off at the other end of the speed range, and more importantly, your speed stability will be compromised. All EZ's (Vari and Long) have excellent speed stability (as do all Defiants). That is to say, if you set the power for a given speed and trim for level flight, the airplane will maintain this speed even if you displace the airplane by pushing or pulling the stick. When you release the stick, the plane will quickly return to level flight and be on speed as before provided you did not change power or trim. If you install overly powerful bungee springs in the trim system, to overpower an incorrectly shaped elevator, your airplane will not return to the trim speed. In fact, it will be difficult, maybe impossible, to trim it to fly level at any speed.

We have tested this by simply removing the trim springs and flying the airplane. We attempt to fly level at various speeds, increasing speed perhaps 5 Kts at a time, until we find the trim speed at which the EZ flys level, hands off without diving or climbing. This speed should be close to 130 KIAS. 120 KIAS is OK, 135 is OK but much more or much less will require a fixed trim tab on each elevator or a new elevator with the correct shape. A small aluminum tab pop riveted to the bottom trailing edge of each elevator and bent up per sketch (See page 12) can be adjusted to cause the elevator to float exactly at 130 KIAS with no springs. This will allow you to use the weakest possible pair of springs that can provide enough force to hold the plane hands off from approximately 65 KIAS to approximately 170 KIAS.

We are not necessarily recommending that everyone go out and fly with no trim springs! On the contrary, while it is not difficult to fly without any springs in the pitch trim system, it is extremely aggravating and tiring because you have to hold the trim force required all the time. You can never relax or let go of the stick. So keep the flight short (or fly at the elevator's natural trim speed, once you have determined it). Do not attempt to conduct a test flight such as this unless you have plenty of experience in the airplane. We have done this many times and it is not that big a deal. It is just not a good idea for a low "time in type" pilot.

With the correct shaped elevator, your bungee trim system should provide you with the capability to trim hands off from around 65 KIAS to around 170 KIAS, no more and probably no less. If you have to push to fly level at 150 or 160 KIAS, your elevator shape is wrong and its lift is stronger than your springs. The only way to fix it is to install the fixed trim tabs (one each side) or to build a new, correctly shaped elevator.

FLUSH RUDDER BELHORNS FOR A LONG-EZ.

A few enterprising builders have designed their own method of hiding the external rudder belhorn and when Mike and Sally converted their Long-EZ, N26MS, about a year

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ago, we started getting enquiries from Long-EZ builders who wanted to do the same. Now that we have a years experience on the system used by Mike and Sally, we feel we can share it with Long-EZ builders who may wish to remove the external belhorns. RAF will be making a simple set of instructions, drawings, sketches and photos available within the next 6 to 8 weeks. These will sell for around $10.00.

The first "flush belhorns" Long-EZ we ever saw was Ben Ellison's Long-EZ (of Ellison Throttle Body fame). A beautiful Long, the simple elegance of the smooth outboard faces of the winglets made it even cleaner. Then we saw Joe LaCour's Long-EZ at Oshkosh and he had done something similar to Ben's and made some sketches as to how he had done it. Mike and Sally decided to use Joe's basic method and it has worked flawlessly for just over a year now. Ben Ellison, Joe LaCour and Mike and Sally's Long-EZs have one thing in common, all have forwarded mounted brake master cylinders. The hidden rudder belhorns method used by all three of these Long-EZs has the rudder striking a hard mechanical "stop" at full throw. This means that it is mandatory to have a strong spring in the rudder cable to allow normal use of the brakes.

While we have not tried this method on a Long-EZ with the brake master cylinder mounted on the firewall, per plans, we believe that with the springs installed correctly, this method should work well. This is only for Long-EZs with the tall, high performance rudders and would not work well at all on the small, original rudders.

First of all, why do it? Mike did it because it looked better and he tells people he gained 10 kts! (which, of course, is nonsense). Obviously, it is lower drag but probably so little as to be impossible to measure. Not having the steel belhorns protruding out of each winglet saves you from catching your clothes on them, it also saves you from bending them on the side of the hangar and cracking the paint but, best of all, from a safety standpoint, it eliminates the possibility of someone flipping the rudder cable end thimble over the back of the belhorn. This can make for quite an exciting take-off if you don't catch it in your preflight! The external steel belhorns are removed and discarded, new belhorns are fabricated (from full size patterns) and installed into the rudders. A new rudder cable conduit must be installed in a different location in the wing. (Much easier to do in original construction but certainly possible as a retrofit). A strong compression spring, rigged like tail wheel springs, must be installed into each rudder cable to allow you to use the brakes after the rudders strike their stops at the end of their travel.

With forward mounted brake master cylinders, the CS-15 belcranks can be removed and discarded and pulleys can be installed in their place between the CS-71 belcrank brackets. The rudder cables can then be routed through the firewall through a short length of nylon conduit, thus eliminating the large slot required when using firewall mounted brake master cylinders. Also, when using forward mounted brake master cylinders, the rudder cables can be small, 1/16" diameter, all the way from the rudder pedals to the rudders.

The simple plans will consist of full size patterns for all parts required, and will cover building from scratch, new construction, as well as how to retrofit to an existing Long-EZ, however, it will be a simple set of instructions and will not cover every tiny detail, rather, it will assume that since you built the airplane, you can surely figure out this simple thing! Mike did take a series of photos of his retrofit, so these will be included plus a brief outline of procedures.

If you would like a set of these "plans", send a check for $10.00 to Rutan Aircraft, Bldg 13 - Airport, Mojave, CA 93501 and Joan will mail them to you.

CAUTION - 8" PROP EXTENSIONS

There have been two failures of 8" long prop extensions that we know of! Neither of them occurred on a RAF design but both were on pusher aircraft. Both prop extensions were purchased from Sport Flight in Florida. We understand that this company manufactures their prop extensions from 6061-T6 aluminum. All RAF-designed (Brock manufactured) prop extensions are machined

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from 2024-T3 aluminum which is approximately 20% stronger. The sizes of the radii between the flange and barrel are critical. At least one of these failures probably was due to a resonant vibration at the natural frequency of the prop/prop extension. This could be a serious matter and RAF is currently working with experts in this field on just

what magnitude the problem is, or isn't. Burt ran his Defiant with 8" Brock prop extensions for over 900 hours with no sign of a problem. We should have a lot more info on this subject in the next CP. If you are currently running an 8" Sport Flight prop extension, our recommendation would be to remove it and replace it with a Brock 2024-T3 prop extension before next flight.

ACCIDENTS AND INCIDENTS

A Washington Long-EZ was circling low level over a sparsely inhabited area when the pilot felt/heard a creaking sound and immediately smelled gasoline. There was obviously a major gasoline leak as he picked out a relatively smooth area and executed an emergency landing. The pilot got out and on his way out thought he saw a hole in the fuel gauge area but right then the fuel caught fire and, unfortunately, the entire aircraft was consumed. The pilot was not injured but the cause of the fuel leak/fire is unknown. There is a highly speculative theory that the aircraft was hit by a bullet! This pilot was a Viet Nam war helicopter pilot and highly experienced in such events and is sure that is what he felt/heard just before he smelled the gasoline.

Not much we can learn here except, perhaps, to refrain from flying low over what could be someone's property - someone who may not want your flying over them and may take action against you. Keep in mind, this is speculative theory, not proven, but a strong possibility. An experienced pilot, well known to RAF and respected by all who know him as a man of integrity.

A Los Angeles Long-EZ pilot/builder installed a breather system from his engine to one of his exhaust headers, similar to the system developed, tested and sold by Wes Gardner and similar to one Mike and Sally have had on their Long-EZ for over 5 years now (with excellent results). The only difference was the fact that an anti-backfire valve (one directional check valve) that Wes calls out and that Mike and Sally have installed, was omitted. On top of that, this aircraft was known to have one cylinder pumping oil (turned out to be a seized piston ring). Oil consumption was very high and this pilot had filled it with 8 quarts prior to taxiing out for take off. Just prior to taking off, the tower informed the pilot that smoke was coming from the engine. His rear seat passenger looked back and saw flames coming from the cowl near the wing root. The tower dispatched a fire truck and the fire was quickly extinguished.

The Long-EZ was seriously damaged, all engine compartment wiring was burned and the foam was melted out of the wing root. It will take several months of hard work to fix.

What caused this fire? Well, this pilot and Mike, at RAF, don't fully agree. The builder feels that the breather tube welded into the exhaust header cracked, allowing oil onto the outside of the hot exhaust, which caught fire. Mike believes, based on his own experience, that without the anti-backfire valve, the hot exhaust gases went into the breather line, melting or burning it off. Since the engine was burning excessive amounts of oil, this line probably had oil in it and when the rubber hose caught fire, it also ignited the oil

which then turned into a hot fire causing lots of damage including melting the rudder cable pulley and bracket. Mike speaks from experience! When he first installed his breather system, he also tried it without the check valve, or anti-backfire valve. He was lucky, he ran it on the ground and, when the hose melted through, he saw it before any more damage could occur. There was no fire in his case, probably because his engine was not using much oil, but the hose from the crankcase to the tube welded into the exhaust was melted/burned beyond recognition in a matter of minutes!

If you are planning on installing a breather system such as Wes Gardner's, be absolutely certain you do it right! He has lots of experience with this, so contact him, better yet, buy his kit and install it exactly per his

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instructions, and you will have an excellent breather system that does not throw oil all over your cowling.

EXHAUST SYSTEM CRACKS

Lew Miller, Long-EZ builder/flyer, reports finding hairline cracks across the flanges and around one exhaust stack after 250 hours of operation. This was a Brock exhaust system and he had been smelling a faint exhaust smell while climbing with the cabin vent closed for sometime and had searched high and low in the engine compartment before he found the almost invisible cracks. He welded up all cracks and has had no more problems and no more smell but says he is not confident he won't have this re-occur since he has done nothing to fix the cause.

We have not heard of a Brock exhaust system cracking before but an exhaust system can, and will, crack if you have excessive vibration. Watch out for this - any exhaust smell in the cockpit is cause to examine the exhaust system with a bright light and possibly a magnifying glass. Please report any cracks to RAF so we may report them in the CP.

AILERON "VIBRATION"

The reports in CP58 have really put the cat among the pigeons! A controversial topic, to say the least. In spite of all of this, only three flyers have reported finding their ailerons vibrating visibly in flight (one was not sure), one reported finding his vibrating at various RPM's while running on the ground -probably true of all EZ's while they are sitting on their wheels (the tires are like springs, as is the gear), so we believe you must look for this problem while in flight and it will be difficult to see and will require a rear seat passenger to watch the ailerons. If you have a visibly vibrating aileron or ailerons, you should increase the mass balance as required to a maximum of what it takes to balance the ailerons with the top skin level. If it only takes 25% or 50% of the maximum to stop the vibration, then that is enough. Unless you know you have this problem, do not change the mass balance.

Brock has the new aileron belhorns available now and many have been delivered and installed. If you have evidence of worn or beaten out rod end bearings in your aileron control system, you should ground your airplane until you have replace the original belhorns with the new part which is about 8 times stiffer and this is out of the vibration frequency that has been causing the problems. A number of Long-EZ owners have reported worn out rod ends, but far more have reported no sign of wear or vibration. Apparently, it depends greatly on the vibration characteristics of each engine/prop/mount combination and it does not necessarily occur in all Longs - watch for it, though, this is a potential accident waiting to happen - always listen to your airplane - it will invariably try to warn you before it bites!

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce PO Box 424 Fullerton, CA 92632 714-870-7551	Wicks Aircraft 410 Pine Street Highland, IL 62249 618-654-7447
FeatherLite PO Box 781 Boonville, CA 95415 707-895-2718	Brock Mfg. 11852 Western Ave. Stanton, CA 90680 714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

SHOPPING

RUSTY FOSTER'S SPACE SAVER PANEL (see several previous CP's), a really neat piece of gear, will be available only until December 31, 1989. Unfortunately, Rusty has decided to discontinue the Space Saver Panel then. If you want one, or want information on one, write or call:

Rusty Foster
PO Box 1569
Portola, CA 96122
916-832-5993

THE BEST FUEL VALVE we have ever seen - anodized aluminum, replaceable body, easily removable barrel (not tapered!), with 'O' ring seals and an excellent, positive, position

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spring detent system. Best of all, it is a simple bolt-in replacement for your existing brass weatherhead or Imperial valve. It is now in stock at both Aircraft Spruce and Wicks Aircraft. It is expensive, at around $120.00, but well worth it in the long run, no more sticking fuel valve, no more disassembling and greasing the valve, just easy, smooth rotary action.

NOSE WHEEL SHIMMY DAMPERS

If you still have the original plans nosewheel shimmy damping set up, you are risking nose wheel shimmy and possible nose fork failure. Bob Davenport, a Long-EZ builder in Vero Beach, FL, has designed and sells the best shimmy damper available. We have never heard of a nose wheel fork failure from anyone using Bob's shimmy damper. Contact:

Bob Davenport
PO Box 650581
Vero Beach, FL 32965-0581
407-567-1844

WHITEY BALL VALVES (Fuel Valve)

The SS-44xF4 stainless steel valve which we recommended for a good fuel valve does have one drawback, it does not have a very wide recommended operating temperature range. No one has ever reported this as being a problem, but a better choice of Whitey valve would be their SS-83xF4, a valve specifically designed for temperature extremes. Quite frankly though, the very best choice of fuel valve is the one recommended in CP58 and now stocked at Wicks and Spruce.

FOR SALE

Continental 0-235, 2340 TT, 160 SMOH, B & C 10 AMP alternator - $3600.00

Escort II Nav/Comm, 2 yrs old $825.00.

Narco AT150 Transponder, 2 yrs old $490.00.

Narco AR850 Encoder, 2 yrs old $225.00.

Gauges, instruments and tools - Call for prices.

CONTACT: John Creel
415-522-4016

Complete set of Long-EZ upholstered cushions - $100.00.

Goodyear brake cylinder - $30.00.

Thermos-type fuel cap and receptacles - $20.00 ea.

Long-EZ full size cover - $80.00.

Complete set of new 0-235 Lord mounts including nuts and bolts - $130.00.

2 Goodyear flight custom tires 500x5 6 ply with 500x5 wheels and brakes, axles and brake discs - $300.00.

2 500x5 wheels only with brake assembly and discs - 200.00.

Nose wheel and tire 280-250-4 -$35.00.

Fuel pump - cylinderal interrupter-type 12 -$50.00.

Sport Flight Long-EZ 0-235 exhaust system - $300.00.

CONTACT: Dick Cutler
Box 1058
Dublin, PA 28917
215-257-0817

Whelan Strobes/Nav lighting system, new - $400.00.

Narco AR-850 Blind encoder, new - $300.00.

CONTACT: Dave Pepper
4735 N. Court
San Diego, CA 92116
619-296-4615

CANARD PUSHER DIGEST

The Canard Pusher Digest for the Long-EZ is still available. The Canard Pusher Digest is basically a recompilation of information from CP24-CP56 into chapters that

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correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, see CP57). Note that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

I've recently managed to get a very good deal on duplication of the updates, and I'm passing on the savings!. Effective immediately, the cost of an annual update subscription drops from $30.00 to $20.00. For those of you who ordered the update service at the higher price, I have already credited your account with an additional 2 updates for each year you ordered, free of additional charge!

CP Digest for the Long-EZ $57.00
(Includes Updates 57 & 58)

Annual Update subscription $20.00
(4 Updates)

Send payment to:

Stet Elliott
Building 12-I-2
Governors Island, NY 10004
(212) 825-0011

We cannot say enough for this publication. It has been an immense help to Mike Melvill in his assisting builders when they call for support. Every builder would find it just as helpful since there are now so many CP's to search through when you need some specific piece of information. Here it is, all nicely indexed and researched for you. Stet and Kim Elliott have done a tremendous job and we appreciate the fact that they are publishing quarterly updates. What a job!
ED

THERE ARE NO PLANS CHANGES FOR ANY RAF DESIGNS THIS TIME.

Please submit any significant plans changes that you may come across as you go through the building process.
Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need help from
you.

FIRST FLIGHTS

Congratulations to Mr. Alvin Grace of La Grand, OR who reports Long-EZ SN1395 has flown 80 hours with not a moments trouble.

Congratulations, also, to Gerard Castaing of Colomiers, France (see photo this CP) for the Jan. 14, 1989 first flight of F-WCGG. Not many of us can park under the Concorde!

Brazilian Francisco Honorato de Oliveira flew his Long-EZ PP-ZFH for the first time June 7, 1988. (See "Letters")

Please send First Flight information to the newsletter so yours may be included. Though we have no way to know true numbers, we estimate over 500 each Long-EZs and VariEzes have flown. EZ-ily the most popular homebuilt of the decade.

LETTERS

"Dear Sirs;

I appreciate the larger print on the newsletter. I also appreciate the accidents/incidents section as these harsh lessons should not be allowed to go unpublicized. With the fatality rate 10 times higher for general aviation than for cars, and homebuilts even worse, we dreamers and "on a wing and a prayer" people must constantly be shocked back into the real world.

Thanks again for all the work you do for us in keeping up with what is going on in the field

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and developing ideas that make flying safer and more efficient.

Larry Freeman"

"Dear RAF,

When I first saw the VariEze in 1978 Oshkosh EAA Convention, I decided that it would be my next plane. It wasn't. When finally the conditions to initiate building an airplane happened, I bought the plans for a Long-EZ, RAF #2001-L, Brazilian identification PP-ZFH.

Authorization to start construction was given by Brazilian authorities surprisingly easy.

More difficulty was encountered in obtaining the materials in our local market. I almost gave up. Styrofoam started to be manufactured in Brazil only three months before I started construction. PVC foam had to be substituted for polyurethane. BID fiberglass is common in the Brazilian market but UND was not available. After a long search, I was able to have it made by special order. Epoxy resin was not a problem. Metal parts where estimated in a very high price.

I traveled to Los Angeles and acquired the remaining parts (metal kit, metal parts, UND tape, landing gear). I returned with approximately 100kg of materials in my baggage looking forward to meet Brazilian customs officers.

Construction went normally, with usual mistakes. I have two spare winglets...

Plans are clear and easy to follow. The Canard Pusher complements all necessary information. Burt Rutan did a marvelous job.

The PP-ZFH did its first flight June 7, 1988. 80 hours already with no incidents. PP-ZFH is the first Long-EZ built and flying in Brazil.

Francisco Honorato de Oliveira"

"Dear RAF:

I now have about 200 hours on Long-EZ N88LE which was completed in June 86. I have been very satisfied with its book performance and reliability. I was pleased to receive "best homebuilt" at the Eastern Regional Fly-In in Orange, Mass. this past June 88. My most memorable "incident" occurred while flying on a cross-country a few months ago. While over Michigan, shortly after I had switched tanks, the engine went silent and could not be restarted. I was vectored by Grand Rapids to Sparta Airport. The Long-EZ is truly an excellent glider when the chips are down, and handles nicely. Water was found in the gascolator and was found to have come from the tank filled at the last fuel stop. I don't know how this could have been prevented. The suggestion of being within reach of a landing site when switching tanks or having plenty of altitude certainly holds true. I would also like to mention that when I constructed the EZ, I installed a fuel filter after the electric fuel pump. Even though I was extremely careful to keep the wing tanks cleaned at all times during construction, I am still finding very small (1/32 inch dia.) pieces of blue foam in the filter. I have found extremely small trace amounts also in the carburetor filter. I

am convinced that frequent inspection of the carburetor filter is critical, and I would recommend the additional filter. I installed it so that it can be viewed easily before flight, and can be easily removed and cleaned.

Keep up the good work with the CP. I've found it to be an invaluable "extension" of my Long-EZ.

Bill French"

SKETCH OF ELEVATOR TRIM TAB OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Magna Liset and Wayne Johnson's 6100 NM course around Australia.

Not many of us get to park under a Concorde! Gerard Castaing and friend do.

Bayard DuPont's Defiant - What in the world engine is that? A radiator, too - surely not.

Left-Wayne Johnson, Right-Magna Liset with their trusty "Round Australia: racing steed.

Murray Bridge taxiing his beautiful, new Long-EZ - Nifty paint scheme!

Long-EZ Pilot's nightmare come true! Joe LaCour's 0-235 engine after dropping a valve. Yes, he did glide back to the airport and greased it on the numbers, prop stopped. It's enough to make you change oil more frequently!

A LITTLE NOSTALGIA! Dick and Mike flying their new Long-EZ's in close formation around the shop! Circa 1980. **PHOTO OMITTED**

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THE CANARD PUSHER No. 60 July 89

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 60.
VariViggen (2nd Edition), newsletter 18 to 60.
VariEze (1st Edition), newsletters 10 thru 60.
VariEze (2nd Edition), newsletters 16 thru 60.
Long-EZ, newsletters 24 through 60.
Solitaire, newsletters 37 through 60.
Defiant, newsletters 41 through 60.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 AM TO 5:00 PM ONLY. If you have parts that you would like us to see and/or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come other than those days, please call so we will be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please give you name and serial number. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. If you are placing an order, it's best to keep it separate from a request for an answer.

OSHKOSH 1989
Burt will be speaking four times at Oshkosh this year. Each forum will be held in Tent #3 on the day and at the times listed below.

Friday, July 28 - 1:00-2:15pm - Topic: General Aircraft, Scaled Composites' Development Projects.

Saturday, July 29 - 2:30-3:45pm - Topic: Builder Support (with Mike Melvill).

Sunday, July 30 - 11:30am-12:45pm - Topic: Darwin-Our Aviation Designer.

Monday, July 31 - 1:00-2:15 -Topic: Pond Racer (with Dick Rutan).

CAFE 400 - 1989
Klaus Savier won overall at Santa Rosa in his remarkable VariEze. He averaged 158.5 MPH getting an unbelievable 47.73 MPG while carrying the equivalent of two 200 lb. people! Outstanding, Klaus, keep up the good work.

Gene Sheehan, in his phenomenal Q-200, narrowly beat Gary Hertzler in his 85 HP VariEze for the second and third places. All three got scores well over 2 million, considerably higher than any of the competition.

It is quite amazing how much performance and efficiency is being squeezed out of these little glass airplanes. Competition like this is what improves the breed. Who would have thought, a few years ago, that a VariEze powered by a Continental 0-200 would ever turn in a speed of 222 MPH over a measured course? Klaus Savier did at Sun-and-Fun in the Sun 60 Race, only 2 MPH behind a 180 HP retractable gear Glasair!

SOLITAIRE NEWS
Don Wemple tells us he has been flying his new Solitaire and self-launching, using his KFM engine. His latest letter tells us he has 8

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hours on the self-launching sailplane and he promises a complete flight report which we hope to bring you in a future CP.

Herb Abrams is ready to fly his Solitaire. He hopes to have accomplished his first flight before Oshkosh. He also intends to have his Solitaire at Oshkosh. Be sure and see this one if possible - he has the most ingenious engine installation with an amazing retraction/extension system that flips the engine over as it retracts, allowing a much larger diameter geared prop. Should really do something for rate-of-climb.

SUN 60 RACE RESULTS
The Questair Venture blew the doors off everybody, including a 420 HP turbo-prop powered Glasair III and three other Glasair III's with an incredible 293 MPH lap. Klaus Savier was the fastest EZ followed by the Long-EZ's of Verne Simon, Tom Coughlin, Stan Sniderman and Dave Ronneberg, all of whom turned in speeds in the 214 to 216 MPH range - pretty impressive.

KANAB HONK OUT '89. (A Shirl Dickey race similar to the Jackpot and Wendover races, and new for '89)

Again it was Klaus Savier in his speedy VariEze winning over the 96 mile course at 218 MPH. Dave Ronneberg turned in a 215 MPH lap in his Long-EZ followed by John Hayes (Long-EZ) at 211.8 MPH, Tom Coughlin (Long-EZ) at 208.4 MPH, Vance Atkinson (Cozy) at 208.1 MPH and Bruce Tifft (VariLong) at 207 MPH.

This "new for 1989 race" was lots of fun. Kanab, Utah is a beautiful place and the people of Kanab were very friendly and want the race back next year. Put this one on your calendar.

JACKPOT 125 PROFICIENCY RACE
This was the 7th annual running of this race and it was fantastic. Shirl Dickey outdid himself this year. Glen Campbell was the entertainer on Saturday night and there were over 70 glass airplanes on the ramp. Five classes of races were all flown safely over the "now familiar to most EZ drivers" 125 mile course. The terrain forces pilots to fly this race at 6500 MSL or above. Even so, there were some pretty amazing speeds turned in.

Dick Rutan won the Ribbon Cutting Contest as well as the Spot Landing Contest. The ribbon cut is fun. A Cessna 172 releases a roll of toilet paper 3000 feet above the ground. It unrolls to make a long streamer. The contestant attempts to cut the paper streamer as many times as possible before reaching 1000 feet above the ground. Dick hit it 8 times! Second place, with 6 cuts each, was shared by Dave Ronneberg, Vance Atkinson and Mike Melvill.

All told, there were 75 aircraft which flew in for the Jackpot weekend, 2 Spam Cans and 73 glass birds - a marvelous get-together, enjoyed by one and all. Don't miss it next year!

Remember, Wendover race is over the Labor Day weekend in September at Wendover, Utah.

VARIEZE CLASS (Per Plans)

1)	Shirl Dickey	Cont.0-200	201.43mph
2)	John Lambert	Lyc. 0-235	200.58mph
3)	Bob Pauson	Lyc. 0-235	199.09mph

Wow, a close race and a first for VariEze's to break 200mph.

STOCK LONG-EZ (Per Plans)

1)	Bob Campbell	Lyc. 0-235	194.70mph
2)	Mike Marker	Lyc. 0-235	179.29mph
3)	Gary Spencer	Lyc. 0-235	179.18mph

SUPER STOCK LONG-EZ (0-320 Eng., Per Plans Airframe)

1)	Dave Ronneberg	Lyc.0-320	222.45mph
2)	Dick Kreidel	Lyc 0-320	220.60mph
3)	Doug Shane	Lyc 0-320	219.22mph

SUPER MODIFIED (Mod. Eng., Mod. Airframe)

1)	John Chambers	Lyc. 0-235/VE	222.45
2)	Klaus Savier	Cont. 0-200/VE	217.96
3)	Howard Drolling	Lyc. 0-235Lancair	194.02

UNLIMITED EZ (Non-Turbo, Anything Goes)

1)	Mike Melvill	Lyc. 0-360/LE	225.55
2)	Wes Gardner	Lyc. 0-320/VE	214.05
3)	Bruce Tifft	Lyc. IO-360/VariLong	211.97

EXHIBITION CLASS (Anything Goes!)

1)	Burt Rutan	Lyc. TIO-360/Catbird	242.09
2)	Dave Goetz	Lyc. 0-360/Lancair	225.21
3)	R. Rodewald	Lyc 0-360x2/Defiant	191.84

B&C SPECIALTY PRODUCTS will be at OSHKOSH '89 in Booth C-11. Their lightweight starter is now STC - PMA'd for all Lycoming engines (0-235 through IO-360, 12 & 24 volt). The price is still the same for homebuilders while the STC'd version is priced a little higher. The Linear Voltage Regulator (low noise LR-2) and sealed immobilized electrolite batteries continue to give good service. Bob Nuckolls from the Aero Electric Connection will be giving forums on electrical systems (3:30am Sunday & Tuesday; 10:00am Thursday). These will be very educational open forums so bring your questions. If you can't make the forums, Bob will be at B&C's booth, C-11 to talk to you during OSHKOSH '89.

THE AERO-ELECTRICAL CONNECTION
Specifically, a very smart electrical engineer named Bob Nuckles, is alive and well. Bob can help with wiring and electrical problems and his newsletter is well worth subscribing to. Bob will be at Oshkosh and will be conducting a couple of seminars consisting mainly of question and answer sessions. If you have any electrical questions, wiring, radios, loran, etc., don't miss the opportunity to get help in person from Bob. His forums will be at 3:30 pm Sunday and Tuesday, and 10:00 am Thursday.

FLYIN AT FOX FIELD, LANCASTER, CA
Sponsored by the Rotary Club, George "Pop" Rutan is helping to organize this show which will feature Bob Hoover and many other well known acts. "Pop" says he will have a protected tiedown area for homebuilts, display aircraft and other aviation related objects. All are invited to fly or drive in on Sunday, September 24, 1989.

ACCIDENTS AND INCIDENTS

LOSS OF POWER ON TAKE-OFF. (PIREP from Bill Perry).
"I am sorry to have to report an off airport landing with my Long-EZ due to loss of power on take off. The result was damage to the landing gear, canard and left wing.

The Long-EZ, serial no. 132, is powered with a Continental 0-200 and has been a joy to fly for the past two years and 200 hours flight time. Recently, I flew the Long-EZ to a nearby airport in Alabama for an "Aviation Day" event. About an hour after landing, I was to participate in a flyby. It was about 12 minutes after I started the engine, with outside temperatures near 90 degrees, before getting into takeoff position. The oil temperature was up to 200 degrees and I was considering cancelling the flight when we were cleared to go. Even though the engine was very warm, the temps were in the green and a crowd was watching, so I decided to takeoff. The takeoff roll was normal although an observer later told me that he saw what appeared to

be smoke coming from the engine. The climb seemed a little sluggish and, at approximately 60 feet, the engine lost power.

I verified that the booster pump was on and, pumping the throttle, got a couple of very brief surges of power. The flight was so short and I was so busy looking for a place to land that I did not look at the fuel pressure and did not attempt to switch fuel tanks. The aircraft was put down in virtually the only field available. It was about 1000 feet long with the always present powerline on the approach end and was ringed with trees. Touch down was 1800 feet beyond the end of the 4300 foot runway and was 300 feet into the field beyond the powerline. The aircraft slid 240 feet in a straight line. It remained upright with the engine still running at a rough idle. The ELT was activated. The engine was shut off with the mixture control. I was not bruised or scratched.

The aircraft touched down nose low because the canard was stalled and apparently the left wing was slightly low. The nose gear shock strut broke and the lower NG-15A casting cracked and came off the gear strut. The gear strut appears to be undamaged. The left main gear leg twisted with some damage to the gear attach point. The prop did not make contact. The left tip of the canard touched, breaking the canard with some damage to the F-22 bulkhead. The left wing made contact with slight damage to the lower winglet and buckling the skin aft of the outboard attach fitting.

I fully expected to go through the trees at the end of the the field and was surprised that the aircraft stopped just beyond midfield. If the plane had not been stalled in, it would have touched down much further down field and would surely have gone into the trees with probable injuries to me and major damage to the aircraft. I feel very fortunate to have avoided injury and to be left with a repairable aircraft. I am impressed that the Long-EZ could be put down in so small a field with so little damage.

I have not been able to identify a probable cause for the power loss. The engine was restarted about an hour after the landing. It ran and accelerated smoothly and both mags checked ok. There was an unusual sooty deposit in both exhaust pipes. After the aircraft was brought home, the engine was run and checked again. The throttle, mixture and carb heat controls have been checked. The fuel tank vents (two per tank) are clear. The fuel flow rate with booster pump on is 25.8 gal./hr. for both tanks. The booster pump was replaced in Nov. 1988 as recommended by newsletter CP 57, pg 7. The engine driven fuel pump has a cooling shroud as per CP 48, pg 4.

It seems likely that there was a partial vapor lock due to the heat soak from the warm engine and minimal cooling air flow. It is also possible that the engine driven pump over heated and caused a loss of pressure. When I look at the carburetor mounted behind, and very close to, the oil tank on the Continental, I suspect the possibility of fuel boiling in the carburetor. This however will not be easy to prove since I don't plan to try another takeoff with an overly warm engine."
William R. Perry

Editors comment: We have talked at length with Bill Perry about what may have caused his loss of power and we suggested carb ice as a possibility. Certainly, as a student pilot flying a C-150 (Cont. 0-200) in the humidity of the midwest, we saw carb ice on take-off at least once when it required full application of carb heat just to make it back to the runway. This would also explain why the engine ran fine an hour later - the ice melted. Whatever it may have been, we have asked Bill to keep us apprised of anything he may come up with during his rebuild and, of course, we will pass it on via the CP.

PROP BOLT TORQUE. (Letter from John Bridges to Arnie Ash passed on to RAF)

"How many times have we been cautioned about checking the torque on wooden props, especially when climates change? Here's the new wrinkle that happened to me.

My Long-EZ, N642JB, has been flying since July, 1987, and has accumulated 283 hours. I have made several trips from Michigan to Phoenix, been to Sun-&-Fun twice, and many more short hops like Rough River and Oshkosh. It has been a great joy to fly and share with others. While in Phoenix, about a year ago, I talked to Great American about the poor climb performance with my 62x62 prop and 0-235C1 engine. They recommended a change to a 60" pitch would solve the problem. I flew to San Luis Obispo on the next day and Fred Griffith met me at the airport where we installed the new prop. I must add that Fred is a super guy and really helped to solve my problem.

The new prop did the job - better climb performance and I could see 2800 RPM at full throttle.

Returning to Phoenix, I removed the spinner and re-torqued the bolts. After returning to Michigan, I checked torque again at 10, 25 and every 50 hours.

Last November, I flew the airplane back to Phoenix for the winter. The airplane stayed in Phoenix until I headed for Sun-&-Fun on April 6th. I checked the prop torque on April 5th to make sure the dry climate wouldn't

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come back to haunt me. Prop torque was perfect and had remained unchanged all winter.

I arrived at Sun-&-Fun on April 6th and stayed until April 13th, and then flew home to Michigan. During the next week, I changed oil, cleaned the airplane and checked prop torque - no change.

On April 23rd, I flew over to visit a friend at another airport. Upon departing that airport, I could not fully retract the nosewheel. It was rotated 90 degrees from normal. I tried twice to coax it back into position without success. Since I only had 20 miles to go, I decided to leave it partially retracted. This was the first time this had happened. About 10 miles later (about 1000 AGL), I started to make a

climbing turn to the left and reduced RPM to 2000, and all hell broke loose. I thought I had been hit by another airplane.

These were my thoughts as the airplane began shaking violently. I looked out - both wings still on - something's wrong with the engine - shut everything off - slow so vibration stops - look for a place to land. The City of Rochester was in front of me so I did a 180 degree looking for a place with no houses, people, cars, wires or trees. There it is, green grass - looks flat - plenty of open field - set up for landing - gear down - slow it down - trees at the other end of field - set it down. Snap, the nosewheel assembly departed the the strut - canopy shattered - nosewheel collapsed, mains folded - wheel pants (Sport Flight) stuck into wings - now I was totally a sled - started turning to the right - left tip of the canard dug in, cut into the fuselage and broke - left wing tip dug in - wing broke at corner of wing spar to inboard aileron cutout - went a few more feet and stopped.

FAA came out to investigate and stated I had picked the best place around but, if I had kept it up another 30 feet I would have missed the tire ruts that I couldn't see, and probably saved the aircraft.

What caused the sudden vibration? One prop blade broke off at the hub. Why? The threads on the prop bolts had bottomed out. Why? Apparently, the prop hub was a little thinner. The prop dried out during the Phoenix winter and the bolts could have been about 1/8" shorter. I was reading torques, but there was no clamping pressure on the prop. I also feel the nosewheel hit something on take-off and threw it into the prop, causing damage to the blade and when I retarded the throttle, it was all over.

Let this be a lesson to all of us, not only to check prop torque, but to also recheck bolt length to ensure any slight variation in hub thickness will not result in running out of threads.

PS I suffered a minor cut on the forehead (no stitches) and a very sore shoulder - it cracked the left side of the fuselage."
John E. Bridges.

Editor's comment. Many of you will recall a similar incident that happened to Dick Rutan while flying the prototype Long-EZ, N79RA, (See CP 32, page 5). Due to the spinner backplate interfering with a radius on the prop extension, the prop bolts did not provide any squeeze up or crush between the crush plate and the prop extension. Neither the drive lugs nor the prop bolts have anything to do with driving a wood prop. Only the friction between the flange on the prop extension and the forward face of the prop, plus the friction between the crush plate and the aft face of the prop, drives the prop. Once you lose the friction grip on the prop by bottoming the bolt threads, as John did, the prop is free to oscillate slightly with each piston firing stroke. This begins to elongate the drive lug holes in the prop and causes vibration. If the pilot allows this to continue for more than 30 seconds or so, the bolts will break at the base of the threads and the prop will depart the airplane (which is what happened to Dick!). The damage to the prop is usually quite graphic, huge elongation of the drive lug holes which causes the bolts to bend back and forth and ultimately break, but also usually the prop face will have evidence of charring. - Yes, lots of heat is generated by the oscillation and it

burns the wood! We believe John's problem was bolts bottomed on the threads. Therefore, little or no gripping pressure between the crushplate and the extension flange, therefore prop oscillates, elongates drive lug holes, perhaps chars the wood, vibration sets in and John shuts the

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engine down. Prop stopped near vertical and when the gear folded the lower blade broke off when it struck the ground. The loss of one prop blade almost certainly did not occur in flight. We would be most interested to examine John's prop, but the above is our opinion here at RAF based on many accident investigations as well as some personal experiences.

A FLORIDA VARIEZE crashed during an attempted forced landing and the pilot, the only occupant of the aircraft was fatally injured. An eye witness reported that the engine cut out and that the pilot subsequently attempted to land on a road. A local EZ builder/flyer reported to RAF that he believed the pilot may have accidentally turned the mag switches off. The mag switches in this airplane were small toggle-type switches mounted high in the center of the instrument panel close to the air vent. The theory is that perhaps because it was hot, the pilot may have attempted to adjust the air vent and accidentally knocked the toggle mag switches off. Of course, no one will ever know for certain, but this theory is plausible and we have certainly seen mag switches mounted like this that could easily be inadvertently switched off.

Use only the "locking" type switches, the ones you have to pull out to move up or down. Or place the switches where they could not possibly be accidentally turned off or on without the pilot's knowing about it.

A TEXAS LONG-EZ experienced an unintentional landing on the dirt foundation of a future runway, causing some minor damage to the airplane but no injuries. During a fly-in, while flying in a high speed/low speed competition, this pilot was slowing to his minimum flying speed and was indicating 65 knots, very nose high, when he noticed he was sinking. At what he judged to be about 20 feet, the nose pitched down. He immediately applied power which he said had no effect, so he pulled the power to idle and held the stick full back. The nose continued dropping and he hit the soft dirt in a 3 point attitude. The Long-EZ slid to a stop in about 300 feet. Damage was minor and he had it flying again the next day.

The weather conditions were good, no rain, light winds and the airplane was being flown very light. What caused this problem? We experienced a situation very similar to this once ourselves, but at the time we were flying with an experimental canard airfoil and it was raining. This test airfoil was retired and not put into production!!

It is not normal for an EZ to behave in this way. There have been rumors over the years that EZ's were prone to this behavior, but that is simply not true. At least of a plans built, correctly rigged EZ. A Long-EZ using the original GU canard, with the elevator rigged so that the full aft stick (FAS) mechanical stop is at a point beyond maximum

lift coefficient, approx. 22 degrees trailing edge down, would possibly exhibit the same characteristics described by this Texas Long-EZ pilot.

It is critically important that the maximum attainable lift on the canard occur at full aft stick. A perfectly built canard/elevator will reach maximum lift at 22 degrees of elevator deflection, however beyond 22 degrees, the lift available will decrease. When you do your initial flight testing check that you are, indeed, getting maximum lift at full aft stick.

We believe it is possible that the above incident may have been caused, at least in part, by the elevator having been deflected beyond the point at which it allows the canard to generate maximum lift. Another contributing factor may have been an incorrect airspeed indication. At 65 KIAS, a light weight Long-EZ certainly should not be at such a nose high condition that the pilot cannot see forward, nor should it stall at 65 KIAS. This pilot may have been much slower than he thought, and had actually reach the stall condition - normally a pitch bucking as the canard stalls and unstalls. If this were the case, this condition might have been aggravated by the main wing getting into ground effect which would cause a small nose down pitching moment due to the long moment arm of the swept main wing and the "cushion" between the wing tips and the ground.

It must be pointed out, however, that it would be a problem to land an EZ if this were a normal characteristic of all EZ's! After all, we have all probably landed at 65 KIAS or slower

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many times without having the nose pitch down prior to touch down or even after touchdown. When the prototype Long-EZ was in flight test back in 1979, we landed it many times at full aft stick. This is not a good method of landing but it can be done with some practice. It does not produce the shortest landing distance, however, and is not recommended. It is only brought up here to make the point that a Long-EZ should not do what this Texas Long-EZ did.

As always, we publish reports on accidents and incidents like these above purely in the hope that by reading them, other pilots will perhaps avoid getting into similar situations. If only one pilot is saved from an accident because of RAF publishing these reports, it is well worth it.

PLANS CHANGES

We at RAF, of course, cannot enforce a mandatory change as FAA can on a type-certified aircraft. The regulations allowing amateur-built experimental aircraft recognize that the homebuilder is the aircraft manufacturer and that the aircraft does not need to conform to certification requirements. This allows experimentation by the homebuilder giving him the freedom to develop new ideas. FAA achieves their goal of providing adequate public safety by restricting the homebuilder to unpopulated areas and to solo flight until his aircraft is proven safe.

It is the homebuilder's responsibility to maintain, inspect and modify his aircraft as he desires. However, we at RAF feel that part of our job is to provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him to achieve a satisfactory level of flight safety.

Category	Definition
MAN-GRD	Mandatory - ground the aircraft. Do not fly until the change has been accomplished.
MAN-XXHR	Mandatory - accomplish the change at next convenient maintenance interval or within XX flight hours, whichever comes first.
DES	Desired - strongly recommended but not requiring grounding of the aircraft.
OPT	Optional - does not affect flight safety.

THERE ARE NO PLANS CHANGES FOR ANY RAF DESIGNS THIS TIME.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

FOR SALE

One pair of Cleveland 500x5 wheels, brake calipers and discs. Never used - $225.00. Contact: Dave Lind
15114 Paso Del Sol
Del Mar, CA 92014
619-755-6117

Composite prop by Klaus Savier for 0-235 powered Long-EZ. Like new - $650.00. Contact: Gus Sabo

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2842 Brockington Dr.
Las Vegas, NV 89120
702-454-0078

Lycoming 0-235-C1, modified for mechanical fuel pump. 400 hrs. since major with chrome cylinders - $4000.00. Contact:
Art Lazzarini
208-726-9103 (leave message)

INSTALLING THE RECOMMENDED NEW FUEL BOOST PUMP
The Facet fuel pumps, part #40108 and #40154 which have the 37 degree flares, have caused some builders to feel that the old pump with the 1/8" female pipe thread was easier to install. We have always preferred the 37 degree dash 6 fitting and do feel it offers the advantage of a large passage for the fuel (less restriction in the line. We had new flex hoses (Stratoflex) made up with 90 degree gooseneck fittings on one end to make the installation easy, however, there is a simple alternative. Aeroquip makes a steel elbow with a swivel nut that fits 37 degree flares that really make this installation straight forward and economical. The part number is 2071-6-6S. They are hydraulic, steel fittings made by Aeroquip and marketed by hydraulic dealers who handle Aeroquip parts. Bill says he will have a few of these swivel fittings with him at Oshkosh and would be happy to get them for anyone who wants them.

We would like to thank Bill Bainbridge for this gem of information.

THE NEW FUEL VALVE
Unbelievably, after all the effort to finally find the perfect fuel valve, we still apparently have problems. We have received reports from both Wicks and Aircraft Spruce that some builders have returned the new fuel valve as unusable, won't fit, not as represented in the CP, etc.!! Even the Cozy newsletter condemned the valve without even looking at it!

WOW!! What can we say? The new fuel valve is all we said it was. It is a direct replacement for the original brass valve. Several EZ owners at Mojave, including Mike and Sally, have installed the new valve and have reported that it is great. It turns so easily, and the strong spring/ball detents are very positive. In fact, the valve can be turned to either tank by feel, without ever looking at it!

There may be some confusion about the left-right orientation of the new valve. Keep in mind that the original valve is identical. If you installed your original valve exactly per plans (i.e., left tank goes to right side of valve and right tank goes to left side of valve, see plans page 21-5), your new valve will fit and work exactly as your old one does. You may have to file an additional flat on the valve shank (there are only 3, whereas the original had 4 flats) depending on how you oriented your fuel valve handle. Other than that, the new valve bolts on to the same bracket, same bolt location, uses the same elbows and fittings and, also, uses your original handle. Remember, this valve was manufactured specifically to replace the brass valve in Piper Cherokees. Since this was the same brass valve, it must fit your Long-EZ! If you have any problems, call Mike here at RAF.

The new valve is available at both Aircraft Spruce and Wicks. It uses "O" ring seals, all of which are replaceable. It turns so freely it has to be used to be appreciated. It has the most positive position detents we have ever seen. Don't let yourself be caught with a stuck fuel valve - get one on order today - even though they are expensive, they will prove to be worth it in the long run.

RAF has received many complimentary letters and phone calls on this valve. We appreciate the feedback on this and anything else you feel might be useful

LONG-EZ AILERON BELCRANK VIBRATION UPDATE
We have had only three reported incidents of aileron vibration in flight in the Long-EZ. Since our original CP article on this subject, only a few builders have found their rod ends badly worn. All of these had steel push rods installed (heavier than the original aluminum

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pushrods). One builder had no problem with rod ends but the rivets holding the inserts into the steel pushrods were loose!

Be sure and check these rivets next time you remove the cowling. Obviously, the heavier weight of the steel pushrods has moved the natural frequency of these parts into a frequency range that can be driven by the engine at certain RPM's. If you have steel push rods installed, check the rivets and the rod ends often, and be sure to replace the original aileron belhorns (CS-132L) with the new double arm belhorns (CS-132L-R) available from Ken Brock.

EXHAUST SYSTEM CRACKS
Since we mentioned a crack in a Brock exhaust system in the last CP, we have had four letters from EZ flyers who have had similar cracks. All report that they are hard to see and generally occur around the weld at the flanges.

Next time you remove your cowling, take a bright light and carefully examine the exhaust system, paying close attention to the flanges. Look for a light grey deposit on the pipes or flanges. Any cracks should be welded up before next flight. TIG welding is required for Stainless steel exhaust systems. Do not ignore a crack in any exhaust system. It may cause carbon monoxide to seep into the cockpit, or a piece of the exhaust pipe may depart the airplane and tear up your prop!

Keep in mind that exhaust systems do not last forever, not on homebuilts, not on factory builts, not even on cars! The constant hot gasses, heating to red hot, than cooling, all the vibration, etc., makes for a hard life. Check you exhaust system often and fix it if it is bad.

DEFIANT ELEVATOR HINGE PROBLEM
Rodie Rodewald just called to tell us that after the trip home to Petaluma, CA from Jackpot, NV, he discovered that his Defiant had suffered some damage to the hinges on the elevators. Apparently, an

engine related vibration drove the elevators to vibrate left and right (inboard/outboard, not trailing edge up or down) which put a big load on the hinge to the elevators' attach point and caused the steel hinges, CS-2, to loosen on the bronze bushings and slip along the bronze bushings. Rodie has suggested the addition of a couple of washers. These should be installed over the bronze bushings to prevent the CS-2 steel hinge from sliding along the bronze bushings - see sketch. Another method might be to cut the bronze bushing down to be almost flush with the steel hinge (CS-2) and use a shorter AN525 screw.

The most important lesson here is that if you detect any left/right movement in the elevators in flight, you should realize that it is probably caused by a resonant vibration from the engine/prop and the first thing you need to do is change the engine RPM. Either decrease or increase the RPM and you will almost certainly get away from the harmful harmonic vibration.

Have any other Defiant flyers noted anything like Rodie has reported? We have looked closely at Burt's N78RA, the prototype Defiant, and there is no sign of anything having moved in the elevator hinge system. Please let us know if you come across any vibration induced wear and tear. **SKETCH OMITTED**

STATIC RELATED RADIO "BLACKOUT"
"Some time ago, I read a report of a Long-EZ

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pilot who experienced static while in flight from New Orleans to somewhere in Texas. I thought I read it in the Canard Pusher, but I have been unable to locate it. (ED - see CP 53). Twice I have experienced both comm and nav "blackout" while flying in light and moderate rain during overcast conditions. The first time during a landing at Liberal, Kansas, in light rain, I thought that Unicom just was not attended at the time. After landing and sending my wife inside to monitor the frequency, I was able to transmit and receive while standing on the ground beside the Long-EZ.

Later that day after departing Liberal, rain was encountered and a 180 executed when all nav and comm was lost. After landing at Liberal, again sending my wife inside to monitor the frequency, I was able to transmit and receive while standing on the ground. A phone call to the FSS at Garden City revealed they had heard none of my transmissions.

I have discussed this "blackout" with several radio repairmen and other composite airplane flyers. All agree that it is likely that a static charge built up on the composite structure and effectively blocked the radio signal until the charge was bled off.

Just this week, I experienced a similar "blackout" at Garden City, Kansas. After talking to Garden City FSS about 15 miles out and deciding to land because of the rain in my intended path of flight, I went a few minutes toward the airport in light rain before calling for a landing advisory. I was unable to contact the FSS until after about a half dozen tries. By then, I was within 2 miles. A visit to the FSS

revealed that they could tell someone was transmitting, but there was no intelligible message.

In discussing this problem with the FSS manager, he told me of his experience in the army when operating helicopters using FM communications. The helicopters had a large amount of composite materials in them and built up quite a static charge. To discharge this static charge before making a pick-up of a fuel cell, they simply keyed the mike for 20 or 30 seconds. After a few minutes of discussion, we surmised that the "blackout" might possibly be broken by simply keying the mike for a long period of time, that is 20 to 30 seconds versus the 2 to 5 seconds that might be used to make the initial callup. Perhaps that was how I finally got through just before landing, making repeated calls in a short period of time.

It is not easy to deliberately set up this condition, especially when I do not like to intentionally fly in the rain knowing that I may experience a "blackout". Perhaps others could report on their experiences in rain, and maybe have occasion to try discharging the static build-up by an extended keying of the mike. Wouldn't it be great if the system could be discharged this simply?

I have 280 hours and over 300 landings on N86PD. What a fine machine! We plan to be at Oshkosh this year."
D.W. Smith

Editor's comment. We don't get much rain flying being based in Mojave, CA, however, we have flown in the rain many times over the past 11 years in Long-EZ's, VariEze's and a Defiant, including an IFR flight from Mojave to San Francisco (Defiant). We were in some of the heaviest rain we have seen for about 30 minutes but never had any problems communicating with ATC or with any nav equipment. At no time can we recall a radio blackout such as Dave has reported. Has any other builder ever had such an experience?

SAFE FLYING IS AN ATTITUDE
This safety suggestion was sent in by former Navy Safety Officer and VariEze pilot, Ralph Gaither.

"I am one of those guys who does more flying than writing, with little input for your newsletter. I modify as recommended and have little trouble with my VariEze. I use my aircraft to support my business as a professional speaker. With reasonable weather - any city within a thousand miles is fair game. My EZ is like many of those heavy ones with full gages, nav package plus loran. I have made my share of mistakes (as noted in my previous comments to you) but have always flown the aircraft first and came out ahead.

One suggestion for consideration. I have a few hours around gliders and one thing these birds teach you is to always have a place to land... I believe we should all keep that in the back of our minds as we travel. I find myself constantly on the lookout for the nearest airport, major highway or just a good looking farmer's field to put down in case of an emergency. It becomes a part of my flying and keeps

me alert too. Nice to have when that surprise comes along. Make it a part of your flying too.

Hope to see you all at Oshkosh."
Ralph Gaither

Editor's comment. An excellent suggestion. Thanks, Ralph. We have practiced Ralph's system for many years now and can attest to its success from a couple of actual forced landings.

NEW BOSE ELECTRONIC NOISE ATTENUATING HEADSETS.
Bose is planning on introducing their long awaited electronic headsets at Oshkosh 1989. The first time we saw these headsets was during the Voyager program when Bose provided Dick and Jeana with the most comfortable headsets we had ever seen. In spite of the fact that they had a couple of minor problems, Dick has said the fact that he experienced little or no hearing loss during the grueling 9 day flight was due to the Bose headsets.

Mike and Sally have been evaluating a couple of pre-production Bose headsets for the past several weeks and will be flying to Oshkosh using them. So far, the verdict is that they are excellent. The comfort on a long trip is so superior to any other headset as to make it "no contest". The noise attenuation, with the electronics turned on, is superb, Significantly better even than the highest passive noise attenuating headsets available (27 DB reduction). They are impressive looking too! The easiest way to sell a set is to let a pilot put one on, power off. Let him feel the comfort, notice the good noise reduction, then turn on the power and watch his face! It is fun because the facial expressions vary from puzzlement to plain disbelief. Be sure to look up Mike or Sally on the flight line at Oshkosh and ask for their "demo". Then go and talk with the Bose people at their booth.

!!! WE AT RAF NEED HELP !!!

We appreciate all the help you've given over the years by sending news and articles that concern builders. As you see by this newsletter, we have relied on you quite heavily. Now - we need pictures! If you have pictures you feel will be of interest to the readers who are builders and flyers, please sent them in. Interesting topics: pictures of you next to your airplane, vacations in your EZ, good building pictures, exceptional instrument installations, fly-ins you've attended, - the list goes on! AND WE NEED THEM FOR FUTURE NEWSLETTERS. So dig thru those pictures you've stuck aside and let us take a look.

They need not be black and white. Nice, sharp, clear color pictures are fine. One request - PLEASE - put your name address and identifying information on EACH photo as they get shuffled while we're working with them. Thanks for the years of help.
RAF

HOW TO CHECK IF YOUR AIRPLANE IS STRAIGHT.
So you have a few hours on your new EZ/Long/Defiant/etc., and you are buzzing around within your limited 25 mile radius of home base - why not spend the required hours you have left to take a close look at your

airplane. Specifically, checking the rigging, the "straightness", if you will, of your brand new creation.

Assume you have built a "perfect" airplane, both wings are mounted to the fuselage at the correct incidence with zero relative difference, the canard is straight and at the correct incidence, and the two winglets are correct and exactly symmetrical relative to each other. This airplane should fly at cruise power, level flight, with the ball centered and both ailerons even and faired with the wing trailing edges. Depending on the CG and the speed, the elevator may also be perfectly faired with the canard tips. Since elevator

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position is a function of speed and, to a lesser degree, to CG position, I will limit this discussion primarily to rudder and ailerons.

How many of you have reached this goal? Not many I would bet. I know my own Long-EZ certainly is short of this state of perfection. How important is it to have a perfectly straight airplane? Difficult to say. Obviously, the straighter it is, the less control surface deflection there will be in high speed flight and the lower the drag and the greater the efficiency will be.

How do you check for a straight airplane? First of all, you will have to have a slip indicator, accurately installed. This can be a short length of yarn stuck to the canopy on the aircraft centerline with a small piece of masking tape (this will only work on gliders and pushers!). Place it about 12" up from the leading edge of the plexiglass canopy. If you have a needle and ball, a turn coordinator and ball, or just a ball, it must be mounted in the panel, ball centered with the wings exactly level. Be sure this is correct before attempting to evaluate the airplane.

Now, before you conduct the following flight test, check to see that the two elevators are rigged perfectly, relative to each other. You will have to remove the canard to check this out. Simply eyeball along the elevator trailing edges. They should be in a straight line. If they are not, you must correct this before doing the flight testing. Elevators rigged incorrectly will roll the airplane.

Also, stand behind your airplane looking at the center of the spinner. Raise or lower your head until your eyes can see along the top skin forward of the trailing edges of the wings. You don't want to be looking down on top of the wings or up at the bottom skins. You must be able to see the trailing edges and the top skins as a line. Now, without tilting your head, look from the right wing to the left. Any differences? Shouldn't be. If you can see more of the top of one wing, you have a relative incidence problem. Make a note as to which way it should roll and verify this in flight.

Take off and establish a high cruise in level flight, feet off the rudder pedals and ailerons perfectly centered (if you can't see your ailerons, take a passenger along to help you get them centered. Remember, your limitations allow you to carry a passenger if they are

essential to the mission)! Now, look at the ball. Is it centered? Are the wings level? Probably not! Bummer, oh well, take comfort in knowing that almost everyone else is in the same boat! Keep the ailerons centered (visually verify this), and "step on the ball", that is, step on the rudder to center the ball. Step on the rudder opposite the direction of the yarn slip indicator. Lock your feet, ball centered (yarn centered), keep ailerons centered, and carefully observe the horizon and your DG (if you have one) to see if the airplane is flying a straight course over the ground or if it is slowly turning. If you have no turning rate and your wings are level with the horizon, you have one or both winglets attached to the wings slightly crooked. Even though you have a small error in your airplane, at least you know what is wrong and it can be corrected.

What if you are turning? Carefully null out the turn. Use just enough aileron in the proper direction to zero the turn. Verify this by watching for zero heading change on your DG or by observing a distant peak or other prominent object on the ground at the horizon. This takes a little time and patience but you can get it perfect if you try. With zero turn rate and the ball centered, check how much aileron and rudder deflection you have and in which direction. An assistant can be a great help here. Have them write down, for example, "right aileron up 3/16", left aileron down 3/16" and left rudder outboard 1/4", right rudder at zero." These dimensions can be quite accurately "eyeballed" with a little practice. If you doubt your passenger's ability to judge this, before you fly, have him or her sit in the passenger seat and you move the ailerons and rudders, using a scale and have them call out what they see. Now you know you have a relative wing incidence problem, as well as a relative winglet incidence problem.

Block the rudder out to whatever the eyeball estimate was by taping a small wood block to the inboard trailing edge of the winglet. When the rudder is released, it should close on this block and remain deflected outboard the estimated amount. Repeat the flight test and

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verify that the ball is centered with zero turn rate.

Now, in the case of a Long-EZ or Defiant, you will have to install shim washers on one of the outboard wing attach bolts such that the wing incidence is altered in the proper direction, i.e., in the example above of the right aileron trailing edge up, this wing would need to be shimmed by perhaps one thin washer (AN960-816L) on the bottom outboard bolt. The left wing probably should be left alone until you look at the results of this change in flight.

Fly it and see if this was enough and if it was in the correct direction. Remember, do this kind of adjusting only in small increments. Use thin washers or thin shim stock, one piece at a time, starting with the wing that appeared to be off when you eyeballed the airplane from behind, whichever wing needs to be shimmed to raise the trailing edge. If one washer on one wing does not do it, add one on the other bolt on the opposite wing. Keep both wings even by eyeballing from behind - do not get one wing much different than the

other. Continue using small increments until the airplane flys wings level, ball centered with zero turn rate.

You now have a straight but ugly airplane! Unfortunately, if you have already painted it, you will have some work to do. If it is still in primer, fair the fuel strakes to match the wing roots with dry micro (West System). To fair the rudder with the upper and lower winglet (on a Long-EZ), use a hacksaw blade to cut through the outboard skin along the rudder hinge line to the top and bottom of the winglet. If necessary, widen this saw cut as required and cut through the foam core to the inside of the inboard skins above the rudder and below the rudder. Check that you can now flex the trailing edges of the top and bottom of the winglet til it lines up with the rudder (still in its blocked outboard position). Now, reduce the amount the rudder is blocked out by approximately 10 percent, fill the saw cuts with micro and force the top and bottom outboard to exactly match to the rudder. Clamp them in this position and allow to cure. Layup a 2-ply BID repair over the saw cuts and fill, sand and finish. Install a permanent block, full span along the inboard trailing edge of the winglet to block the rudder in its proper faired position. You can use wood or a piece of pre-cured glass here.

Your airplane should now fly straight and the winglet repair will not be detectable.

This works great on a Long-EZ, but what about a VariEze? Since it is not possible to adjust the incidence of the wings of a completed VariEze, you will have to do surgery to the TOP of whichever wing it takes to correct the tendency to roll. If it rolls left (ailerons centered), you will have to slit the top skin of the right wing, outboard of the aileron along the aileron hinge line and bend this trailing edge up as described for Long-EZ winglets/rudders. If you have to do this to your VariEze, call me at RAF and let's discuss it before you do it.

Well, I hope this is helpful and not too confusing. I'd be happy to discuss this with any builders or flyers who may find themselves having to make this kind of correction.

Mike Melvill

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

A few of the planes at the Kanab Honk Out

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

ER GROOTERS sent in these shots of his method of installing the gear in his Defiant. Jigging for installation of the main gear attach tabs.

MAIN GEAR bulkheads remain jigged together through installation in the fuselage. A great idea!

Using a hole saw to open the pilot holes in the attach tabs.

The entire main gear/bulkhead assembly is taped into the fuselage.

Our leader, BURT, flight planning his trip home from Jackpot while Bonnie Tifft and Sally Melvill observe.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Don Foreman's new NG-1/NG-2 nose gear strut.

Detail of the end of Don Foreman's NG-1. Note: Heavy duty adjustable pivot end. Don's own design and a good idea - makes it much easier to install.

Charlie Gray's second Defiant going together in his shop. Rakish roof line, Charlie!

Donald Douglas' plans-built Long-EZ ready to paint. Don's Long-EZ has made its first flight now - Congratulations!

Peter Froidevaux with his beautiful Swiss registered Long-EZ.

Charlie Gray with his second Defiant! Charlie has completed two Long-EZs and two Defiants.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

The Model 143, a light business jet powered by Williams FJ-44 jet engines, can seat 6-plus, a crew of two, has 1600 NM range and can go 400 KTS at 35,000 feet. First flight was 17 July, 1988.

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 61.
VariViggen (2nd Edition), newsletter 18 to 61.
VariEze (1st Edition), newsletters 10 thru 61.
VariEze (2nd Edition), newsletters 16 thru 61.
Long-EZ, newsletters 24 through 61.
Solitaire, newsletters 37 through 61.
Defiant, newsletters 41 through 61.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 AM TO 5:00 PM ONLY. If you have parts that you would like us to see and/or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come other than those days, please call so we will be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please give you name and serial number. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. If you are placing an order, it's best to keep it separate from a request for an answer.

OSHKOSH 1989
Burt and Tonya departed Mojave and flew to Dayton Ohio, in the Catbird where Burt had a business meeting the day before the Oshkosh flyin. He flew into Oshkosh skirting some pretty nasty weather on the first day of the show. Mike and Sally flew their Long-EZ (her 9th year at Oshkosh!) from Mojave direct to Norfolk, Nebraska for lunch, then direct to Oshkosh. Flight time - 8 hours and 16 minutes. They flew at 17,500 feet breathing O2, average ground speed was 176 knots and the flight was flown using Doug Spear's AP-1 Auto Pilot tracking the Northstar Loran which did not glitch once between Mojave and Oshkosh.

Mom Rutan counted 99 EZ's, Defiants and Viggens at Oshkosh but the airplanes are so scattered about the airport these days it is difficult to say if that was all there were.

The big news at Oshkosh, for us anyway, was the presence of the Russians. We were fortunate to meet most of them and, of course, Burt had the designer of the Sukhoi 26M, a fantastic aerobatic airplane, as a guest during one of his talks, and all who were present had to have been impressed with this man's knowledge, integrity and quiet sense of humor. He even went so far as to invite us EZ flyers to fly to his country next year to attend a major flyin. Several people we know are actively pursuing this.

Coming back from Oshkosh, Burt and Tonya headed straight back with a lunch stop at Aspen, Colorado, while Sally and Mike took a weeks vacation visiting the Waterton Park in Canada (just north of, and actually part of, Glacier Park in Northern Montana). Quite the most beautiful place these two had ever seen. After hiking all over for several days, they flew on to Seattle, Washington, for three more days before returning to Mojave. Perfect weather, perfect scenery, good friends and lots of airplanes. What more could you ask for?

If you are looking for a simply wonderful place to fly to and spend a few days, fly in to Lethbridge, Canada, rent a car and drive in to Waterton Park - Wow!

CONGRATULATIONS, FRED KELLER!
Fred became the first builder ever to win Grand Champion Homebuilt with two different airplanes. In 1980, Fred won Grand Champion Homebuilt with his marvelous VariEze and this year, 1989, he did it again with his original design, the "Prospector", a Fred Keller bush plane. Super job, Fred. For more details, read Jack Cox' excellent article on Fred's new design in October's Sport Aviation, Fred and The Prospector as featured on the cover.

FLO IRWIN, IN MEMORIAM
The founder in 1965 of Aircraft Spruce and Specialties passed away in June 1989.

I first got to know Flo when I began placing phone calls to Aircraft Spruce to order parts and materials for the construction of my VariViggen. This was in August of 1974. She was friendly, incredibly efficient and knew far more about what I needed than I did! Her help and advice, and the marvelous service she provided were very instrumental in the building of my Viggen, N27MS. This aircraft was later the reason for my getting the job I still have, working for Burt Rutan. I feel that Flo was indirectly a part of my getting this job. In 1980 when Sally and I decided to build our Long-EZ, I called Flo to check on parts and materials availability and to tell her what we were planning. Being a very astute business person, Flo could see immediately that the Long-EZ plans, and therefore, materials would be positively influenced by Burt's employees building his latest design, and she gave me her private phone number so that anytime I needed parts, all I had to do was call her and she would personally hand carry my order to the shipping department. Dick Rutan then decided to build a Long-EZ also and, in fact, Sally and I and Dick built the two Long-EZ's together. As anyone knows who is building or has built a homebuilt, one of the enormous frustrations is finding you need a part

or some material you don't have and then having to wait sometimes for weeks to get it. Well, with Flo so positively on our side, Dick and I never had to wait for anything. We would call in an order one day and have it in our hands the next day. Flo was wonderful to deal with in person and on the phone. She was so sharp and so knowledgeable about aircraft parts. I do miss her and will miss her an awful lot.

The fact that Sally and I managed to complete our Long-EZ in only 5-1/2 months from the day we picked up the kit till the day we first flew, is in no small way due to the simply fantastic service that Flo provided to us. Thank you, Flo, for all you did for us and for the enormous influence you had on sport aviation.

Flo's son, Jim, has pledged to continue to provide Aircraft Spruce's customers with the very best service anywhere and with a woman like Flo Irwin for a mother and a role model, we are betting Jim will do it.

Mike Melvill - Editor.

KUDOS KUDOS KUDOS KUDOS KUDOS
"With the possible exception of the P-51, my EZ is the most fun of anything I have ever flown in 46 years of flying - including 25 years military. On second thought, my EZ is the most fun."
Bob Woodall

SOLITAIRE NEWS
"My Solitaire, 78DW, was finished, christened, and duly inspected by the local FAA officials on the 14th of March 1988. The first flight, however, did not take place until the 1st of October, almost seven months later. The reason for the delay was a matter of insurance. I have never carried hull insurance on any of my sailplanes. I've been flying sailplanes for over 35 years and have been an owner for over 25, yet I've never had a major accident necessitating a claim. So I feel that I have saved more than enough in NOT making hull insurance payments through the years to pay for the total destruction of at least one sailplane and still be money ahead! I do, however, feel that liability insurance is a must. I don't have much, but what I have managed to accumulate, I'd like to keep.

So, after the inspection, off to the telephone to call the Soaring Society of America's approved agent with whom I also have liability insurance for my Schweizer 1-26 and Standard

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Libelle. I pay about $160 per year on each of those two ships, and when the company quoted me $760 a year for the Solitaire, they really got my attention!~ Words that bothered them were; "Experimental", Self-launching", and "Motorglider"! Even talking to the head of the company had no effect in reducing the premium, so I looked for other carriers. In Sport Aviation, I finally found one that would give me liability coverage at a relatively reasonable price, $172 per year. There was a catch, however. I had to have a third class medical certificate! Normally no problem, but I had suffered a heart attack two years previously, and as you might have heard, getting a medical for the first time after a health problem like that is no small task.

I won't go through the entire story, but after cardiologist examination reports, treadmill tests, radio-thalium heart perfusion scans plus a lot of letters and telephone calls to the FAA medicos in Oklahoma City, I was finally granted a certificate and applied for the liability policy. It came through on my 59th birthday, in late September, and on October 1st I was out on the runway at Ryan Field, Hemet, California with 78DW.

One great advantage that a self launching sailplane has over a conventional one in its early test flights is that power can be added gradually during separate passes down the runway until finally one reaches liftoff speed. It gives one quite a bit of time to get accustomed to the feel of the controls before really taking that first flight. I can remember that in my flight testing of the Schrede HP-18 that I built eight years ago, the few, low-speed auto tows that I made certainly didn't prepare me for the first real airplane tow!. I had planned on this first day of Solitaire testing to do only slowly increasing speed runs down the runway. The first run indicated that the ailerons were very adequate to balance the wings at about 5-8 kts. speed. They also did not seem to be overly "twitchy", but well balanced. I got up to 25 kts. then throttled back as I passed the center taxiway finally turning at the end of the runway to go back for another try. My next run of 35 kts. showed me that I was able to raise the ship easily off the front wheel, holding the canard quite level and supporting its weight with its lift. On the third run at 40 kts. I got airborne and things felt very comfortable indeed. I had a chance to try the spoilflaps on that one and they responded as advertised--plenty of drag but with no pitch change as one gets with simple flaps. That run went so well there just seemed to be no reason not to try to go-around on the next pass and off I went. The rate of climb was rather slow, but I knew that my engine RPM was a bit low due to an inadequate extractor system of my own design, but was still faster than some contest tows that I have experienced with the HP-18 fully loaded with water. Once around the patch went perfectly. Deployment of the spoilflaps resulted in a nice smooth landing on the rear wheel and then a gentle lowering onto the front.

Later that afternoon when thermal conditions were a bit better I took a second flight that lasted over an hour and a half. During that flight I was able to do some control tests for possible flutter--increasing the speed in 5 kt. increments and slapping the stick and kicking the rudder pedals. I was able to carry on these tests up to 100 kts. and there was no indication of the slightest flutter in either aileron, elevator, or rudder. In later flights I was able to expand this envelope to 120 kts. In the hands off mode, the Solitaire's nose drops slightly and the speed gradually increases to 75 kts. then the nose rises and speed backs off to 55. Slow oscillations continue until the speed stabilizes at 63 kts. During this time the flight path is absolutely straight ahead with no tendency to fall off on one wing. Thermalling speed, 45kts., requires a bit of back pressure on the stick and reminds me that I should install a trim mechanism during the next maintenance session.

"Tuning" the exhaust is an important part of getting the maximum out of a two-cycle engine such as the KFM 107e. With my self-designed system I was able to develop only 5200 rpm rather than the 6300 that the manufacturer says is possible. Rather than to immediately redesign, I

phoned up RAF since I knew that they were not actively flying the prototype and asked if I might borrow their exhaust system. Within 4 days it arrived UPS! Love that builders support! I did have to fabricate a new set of headers for the RAF system since there appears to be some variation among engines, but I found that once it was installed, my rpm was now a stronger 5500. Flying after

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the first of the year showed an improved rate of climb--now 250 fpm--and using low altitude thermals to circle in while the motor was still running allowed rates of climb exceeding 500-600 fpm and a rather brisk climb to an altitude where I could safely stow the engine and go entirely solar powered. The flight on the 12th of March illustrates what the Solitaire can do: a 12 minute engine run resulted in a 4 hour flight with a maximum altitude gained of 6000 feet.

There are still a few changes that I want to make on my ship--a continuing process as all of you builders know. I am fabricating a new muffler that utilizes the twin-pipe Gemini system that was not available when the prototype was built. My two-cycle exhaust experts tell me that you always court disaster in the form of backpressure when you try to merge multiple cylinder output into a single expansion chamber. Secondly, I want to install a device on the inside of the canopy like the one on the "..ezes" that prevents the canopy from fully opening in flight if the latch fails. Yes, mine did! Fortunately I was at 4000 feet and not just taking off or landing when it could of caused a LOT of trouble. I did manage to lose my headrest cushion and my hat in the process. Also one of the arrow shaft pieces to which the cushion is attached managed to break off and jam, preventing me from closing the canopy after it once blew open. So I had to hold the canopy closed with my left hand, hold the stick with my right, and make a landing without spoilflaps after calling a "MayDay" to clear the pattern! No problem, really. My over 2000 hours sailplane time, however, was a help.

Some of you who follow sailplanes know that the Solitaire won the "Sailplane Design of the Year" from the Soaring Society of America in 1982. Burt and Company actually designed and completed the prototype in that one, single year, a miracle that we have come to expect from RAF, but certainly found nowhere else in all of aviation. The thought of an inexpensive, relatively easily built, self-launching sailplane, excited the imaginations of a lot of us. I personally talked to Walt Mooney, one of the more prominent test pilots of experimental aircraft among us, who had flown it at the SSA "flyoff" at Tehachapi. He had glowing praise for it in all respects. Unfortunately RAF didn't have Mooney do the follow-up article about the Solitaire in Soaring magazine. Rather they asked Einer Enevoldsen, a professional test pilot, to evaluate the ship. Einer, a very competent sailplane pilot with whom I've flown in competition, chose to compare the performance of the Solitaire to what might be considered the "standard" of America's sailplane fleet, the Schweizer 1-26. He particularly spoke of the inability of the Solitaire to climb in small circles--something the 1-26 is most noted for. Just this paragraph alone in his article was, I think, enough to spell the death knell for the Solitaire within the soaring community. There is nothing that turns off a glider pilot

faster than to say that a ship doesn't thermal well! It is too bad that Einer had to compare the Solitaire to ANYTHING! It, like all of Burt's designs is incomparable! Just to look at it--like a VariViggen, the "-Eze's, the Grizzly, the Defiant, and the Voyager--says that it's a different breed of a soaring machine! Well, anyway, the damage was done, and the dreams at RAF of radically changing the face of soaring in America collapsed as well as those of Task Aviation at Santa Paula, producers of the spars, fuselage shells, and accessories, when those parts just didn't sell as expected. There does appear to be out there somewhere about 25 or so uncompleted Solitaires. Let's hope that most of them will eventually see the green air of a good thermal because this sailplane is fun to fly.

Don Wemple
Diamond Badge #350 (#9 in 1-26's)"

FAA - ENFORCEMENT PROGRAM
We noticed in the latest Sport Aviation magazine that the FAA has petitioned the US Congress to extend its current temporary authorization to act as prosecutor, judge and jury in aviation related enforcement cases.

The FAA currently has a zero tolerance civil penalty enforcement program in force and their ability to continue this authority, that many legal experts believe to be unconstitutional, depends on you, the voter! This temporary authority will expire on December 30, 1989.

For the sake of everyone who flies, everyone who reads this is urged to call, write or wire his other Senator and Congressmen immediately, asking them to not extend this authority. Let's get back to the situation where the FAA was indeed helpful to the pilot who inadvertently made a mistake, encouraging the pilot to get more training instead of what we have now where the only thing the FAA appears to be interested in is enforcing the maximum possible penalty on every pilot, no matter what the circumstances of his or her mistake.

The FAA is currently holding public hearings on its regulatory review of the rules governing the training of pilots, flight and ground instructors. An EAA representative at one of these hearings has pointed out to the FAA that part of the problems currently faced by general aviation is simply over-regulation. "FAA is, in fact, smothering general aviation to death with a blanket of ever increasing rules and regulations, regulation that cannot be justified by any statistical evidence." FAA, of course, ignores these facts.

The FAA was originally charged by the congress with ensuring the safe development and growth of aviation. Their current zero tolerance enforcement plan does not accomplish this at all. Contact your Senators and Congressmen and let them know your opinion. No segment of this country ever was intended to be ruled by a dictatorship, but rather by the people. You can make a difference. Let your thoughts be heard.

STRONGER, STIFFER NOSE GEAR SHOCK SPRING.

Nat Puffer, designer of the Cozy, has found and has tested a shock strut spring that is much stronger than the original. Several Long-EZ builders have tried this spring and all have reported good results. If your shock strut does not stay all the way up with you in the pilot seat, you may want to consider one of these springs. The are available from:

Danley Die Set
3019 South Tanager
Los Angeles, CA 90040
213-685-8151

EXHAUST THOUGHTS
Ever since Mike and Sally installed a four separate stacks exhaust system on N26MS in July of 1985, RAF has received many inquiries as to where to get one of these systems. Well, Mike built it himself, was impressed with the noticeable power increase but had problems getting the 4 pipe system to stay together. It seemed that each time they landed after a flight, the exhaust system had yet another crack in it. Time has gone by, several more exhaust systems have been built and tested. Vance Atkinson, VariEze and Cozy builder built and tested one for his Cozy and made the statement at Jackpot, NV, that it was the single biggest improvement he made to his Cozy. On the other hand, Dick Kriedel built one and reported essentially no change on his Long-EZ. Doug Shane has one of Mike's on his Long-EZ with over 400 hours on it now and no cracks or failures. Mike has probably got 250 hours on the latest configuration with no cracks, so maybe it is something for the person who wants to experiment and is not afraid of the work that will be involved in making the exhaust fit the cowling! This is not a trivial task, by the way.

Anyway, making one of these exhaust systems is a lot of work, and none of RAF's present suppliers are set up to do this work. However, we were down at Santa Monica airport recently and we saw Dave Ronneberg's welding fixture and several examples of his version of the 4 separate pipe exhaust system. They look very nice. He has done a lot of development work himself on his own Long-EZ and most of his friends and associates are running one of his systems. Dave is a very knowledgeable Long-EZ person, having built, helped build, and generally worked around more Long-EZ's than anyone we know. If you are interested in a 4 pipe exhaust system for your Long-EZ, give Dave a call or drop him a line at:

Experimental Aviation
3021 Airport Blvd. #109
Santa Monica, CA 90405
213-391-1943

WARNING-EXHAUST SYSTEM CRACKS
We have recently seen two sets of Brock exhausts for Long-EZs with cracks around the flanges, in one case the flange itself was cracked in half. We have also received a written report from one other builder who had a similar problem. We do not understand why, suddenly, there are some failures of these exhaust systems. We ran two of these

systems for over 1000 hours each here at RAF and Dick Rutan has almost 1700 hours on his Brock exhaust system to date. The Long-EZ was introduced in 1980, the first homebuilts started hatching in 1981 or so. Not one report of a cracked exhaust system until recently. While we do not believe this to be a major problem, we do believe that your exhaust system should be very carefully inspected using a bright light. If any sign of exhaust gas leakage is found anywhere on the exhaust pipes, the entire exhaust system should be removed and thoroughly cleaned and then carefully inspected, paying particular attention to the welds and especially the welds holding the stainless steel flanges on to the tubes.

If any cracks are found, they may be TIG welded if they are not too bad. However, if the exhaust has very much time on it, even the TIG welding won't hold for long due to contamination. In this case, it may wise to simply install a new exhaust system. In any case, new exhaust gaskets must be used when installing any exhaust system unless you use approved re-usable gaskets. Keep in mind that if there is an exhaust system leak inside the cowling, it may be possible for some carbon monoxide to find its way into the cockpit. A carbon monoxide cockpit indicator is an excellent idea.

IMPORTANCE OF WHEEL BALANCING

Many builders ignore this rather important step. Our plastic airplanes with their plastic gear are probably more prone to being effected by an out of balance wheel than a standard spam can, but all airplanes will benefit from keeping the wheels balanced.

Do you experience a vibration right after lift-off? Can you see the canard tips vibrating up and down at this point? If so, you need to balance your main wheels, and perhaps even the nose wheel. At RAF we religiously balance all of the wheels on all the aircraft, and we do it fairly routinely, usually at least once a year at the annual.

You will need to build a pair of knife edges. Planer blades from a thickness planer, or jointer will work very well. They should be bondo'd to a "U" shaped wood frame so that the steel blades are level to each other and exactly parallel. Now you will need an arbor. It probably is not practical for each individual to make his or her own arbor, rather a group or chapter could make one (or get it made) and lend it to the members. Dick Kreidel very kindly sent us a drawing of one he machined out of a length of 2" diameter cold rolled steel (CRS). The wheel is slipped onto this "axle" type arbor, an axle nut is used to secure the wheel, then the arbor is set down on the knife edges. Use sticky backed tape lead weights (available from any wheel balancing garage which handles mag wheels) to balance the wheel. The idea is to get it to the point where the wheel will not roll either way. The weights should be stuck inside the wheel or inside the brake disc. Just be certain that there is no interference with the brake caliper. You may be shocked to find out just how much lead weight it takes to balance your wheel, even with a new tire installed. However, you will be delighted when you see the difference just after lift-off. Balanced wheels can also help the vibration some EZ flyers see in the gear on rollout. **SKETCH OMITTED**

SPIN ON OIL FILTER FOR CONTINENTALS A-65 THRU 0-200
Gary Hertzler has designed and is testing a spin on oil filter adaptor which fits all Continental engines. He is very pleased with it so far and says that it offers less flow restrictions than the stock screen which it replaces. He gets slightly higher oil pressures at idle with the engine hot, and no oil pressure fall off with high oil temperatures. The only disadvantage he has found is the increased weight which he estimates at approximately 1.5 lbs. However, he believes the added engine life and, possibly, longer time between oil changes would offset the weight disadvantage.

Gary has offered to provide a free drawing of this adaptor to anyone who will send him a self addressed, stamped envelope. This drawing would have to be taken to a machine shop and used to machine up the oil filter adaptor which is designed to use the Fram PH2951 oil filter.
Send SASE to: Gary Hertzler
2507 E. Balboa Dr.
Tempe, AZ 85282

ACCIDENTS AND INCIDENTS
A New York VariViggen crash landed in the Piconic Bay shortly after take-off when the engine quit. The pilot, an experienced Viggen flyer attempted two re-starts but could not get it to run. He then turned into the wind and executed a near perfect gear up water landing.

The Viggen floated and the pilot was quickly rescued by some pleasure boaters. The Viggen was towed to the beach and, after spending some 20 hours in salt water, was returned to its hangar. The left wing root was heavily damaged and the builder probably will not rebuild. The pilot was bruised and shaken up but not seriously hurt.

The cause of the engine failure was traced to the mixture outer cable attach point near the carburetor. This attachment had been perfect for seven years and almost 600 hours but failed at 600 feet over the bay shortly after take-off. This failure was such that the mixture lever arm on the carburetor was pulled to the idle cut-off position. The pilot was unable to richen the mixture, or even to move the mixture at the carburetor, in spite of his best efforts.

What can we learn from this accident? Engine controls are every bit as important and critical to flight safety as flight controls are. Check your engine controls for correct travel and try to imagine what you could do to make sure that no matter what fails, the mixture fails to full rich and the throttle fails to full power. The opposite result is simply unacceptable. A spring that pulls mixture and throttle arms to full rich and full power could prevent such a problem. At least with full power you could use the cockpit mixture lever to regulate power (it works just like a throttle) or even the mag switches to cut power off to facilitate a landing. Using mag switches to regulate power is not as good as using the mixture control. Above all, check that the clamp that secures your throttle outer cable and mixture outer cable are as near perfect as your ability and skill allows. A failure here is not acceptable.

"Dear Burt,

I regret to inform you that VariEze Serial No. 235, N13EG, "Old Dog's New Trick", was destroyed in a landing accident at Blackhawk Airport, Cottage Grove, WI on Saturday, July 29, 1989.

After planning to fly to Oshkosh on Thursday, the weather wasn't reported as good until Saturday when the Washington FSS allowed as how it was good weather all the way to Oshkosh so I took off and flew to Findlay, Ohio, planning a fuel stop there. When I got to Findlay, they were giving Special VFR clearances from the FSS there. I called the FSS and when they answered my transmitter went out so I could not reply to them. So I flew on to Putnam County Airport about 30 miles west of Findlay, landed and called the FSS on the phone and explained the situation. As Oshkosh did not want you to talk to them, I decided to press on as I could receive very well. I then flew to Porter County Airport at

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Valparaiso, IN. Findlay FSS also gave me a good forecast for my route. After refueling at Porter County, I proceeded to the Peoria VOR and took up a 337 degree heading to miss the Chicago TCA. When I reached the town of Marengo, IL, I was due south of Oshkosh so took up a 360 degree heading. I had not been able to go higher than 3500 MSL after leaving Putnam County and the ceiling now started dropping. Soon it started to rain and I did a 180 and ran out of it again. Deciding that sitting it out on the ground would be the best idea, I started to look for airports on my chart and spotted Blackhawk about ten miles east of Madison. I was tuned to the Madison VOR and was on the 90 degree radial. According to my chart, there was a super highway running near Blackhawk so I flew until I spotted the highway and turned west, as I got onto base leg the rain started again. I could see alright out of my canopy except for the critical lower front area where I needed to see the runway. On my first pass, I could see that I was too low so I released the landing brake, added power and started a go-around. Just then I heard and felt a thump but the airplane kept on flying and climbed out. I checked what I could from the cockpit and discovered that the front of my left winglet had a crushed area about the size of my hand just above opposite the top of the rudder.

The only thing I can figure was that I had hit a big bird as I was flying over a cornfield and there were no trees or poles in the field. I climbed out and then tried to land the other way. This time I was all set up but had closed the air vent to keep the rain out of my face and just as I came down final the canopy steamed up so it was another go-around. On my final pass I tried Runway 27 again. I was set up well and as the runway was 2600 feet I was trying for the numbers. I could see that I was to the left of the runway so I banked right to line up, just as I banked left again, I felt it hit.

What I hadn't seen in the rain was that Runway 27 had a 275' displaced threshold because of a mound with a cornfield and a road that was about two feet higher than the end of the runway. The main gear and the left wingtip hit the edge of the road and separated from the airplane. The fuselage then skidded across the grass and up the runway, stopping just on the right edge of the runway just before the displaced threshold markings. I was completely unhurt so unbuckled my harness, opened the

canopy and stepped out into the rain. The ELT worked because even though the radio was tuned to 119.3 the sound of the ELT signal could be heard.

The destruction was almost total, the only thing that could have been salvaged was the canard and that had some tip damage. The left wing had been torn from the center section spar. The left side of the center section spar outboard of the fuselage had been torn off separately,. The center section spar with the engine mount, engine, and fuselage tank had ripped loose from the fuselage and the fuel strakes, the only thing keeping it with the fuselage was the aileron torque tube. The right wing attach fitting was wrenched both at the wing and the center section spar. The fuselage lower aft cover was ripped off when the gear separated. It had the all glass gear tabs according to CP 14 and the tabs stayed in the airplane, although the gear legs did delaminate between the tabs. The nose gear failed to the right and crushed a small section of the lower nose. The belly of the airplane was surprisingly unscathed, just some paint scratches, at no point was the fiberglass abraded through. The engine sustained some damage, the main thing was the air intake pulled the carburetor with the intake spider attached loose from the case, breaking one bolt and cracking the boss where the other bolt was attached. The carburetor and intake spider stayed with the carcass held on with the fuel line. When the left wing separated, it swung in and dented the valve covers on cylinders 1 & 3. The propeller was shattered and the spinner had a few dents. I was lucky that it was raining as the center section spar coming loose dumped all the fuel into the engine compartment. The lower cowling and wheel pants disintegrated.

What should I have done? The first two things were lapses of memory. When I was getting the airplane ready for the trip I had planned to put RAIN-X on the canopy after polishing it but I left the RAIN-X home. The second item was that I forgot my handheld radio when I started on the trip. I'm sure that the canopy would have been easier to see through with RAIN-X and the handheld radio would have

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allowed me to go into a controlled field with long, wide runways. Next, when I ran into rain again I should have headed south again until I was well in the clear, there was plenty of fuel on board, having flown less that 2 hours on full tanks. Also I could have dialed up 7700 on my transponder and gone on ten miles to Truax Field which has an ARSA, I was definitely in an emergency situation.

To what do I attribute my luck in being unscathed? First of all to a great design, the one witness to the accident stated that the airplane came apart just as it was supposed to,. The fuselage cocoon ended up intact. The seat belt and shoulder harness helped. Also had TEMPER FOAM cushions, even though the airplane hit with such force that it broke the bracket on the back of the radio stack the cushions absorbed the impact so that I could not feel it. I'm sure that the TEMPER FOAM saved me from serious back injury.

Such is my sad tale and is the reason that I did not see you at Oshkosh this year.

Sincerely
James O. Eggleston"

Many thanks, Jim, for this accurate and honest accident report. We can all learn from an accident like this. Rain-X is a great idea when flying into rain, and carrying a hand held radio for emergency use is another. ED.

A Florida Long-EZ was heavily damaged during a landing attempt on a grass strip. Reportedly, the aircraft drifted off the edge of the runway area during the landing roll and struck two concrete culverts. The pilot sustained serious leg injuries and had to be cut out of the airplane. There was no fire and the pilot, who never lost consciousness, was able to talk with the firemen and medics who were helping to get him out. We are hoping to receive a report from this pilot when he has fully recovered. If he agrees, we will publish it in the CP at that time.

An Alaska Long-EZ struck the top of a tree and crashed, fatally injuring the builder pilot. The pilot was apparently practicing night landings and got too low on final, crashing into the tree.

This kind of accident is by no means confined to homebuilt aircraft, in fact, it is unusual in homebuilts. Night landings, especially at a country airport with few lights around, can be demanding and require lots of proficiency and extra care.

A California VariEze crashed during an attempted go-around after landing and drifting off the runway.

The aircraft struck several landing lights then hit a 10 foot high earth berm and crashed into a fence. The aircraft caught fire and was completely destroyed. The pilot was severely burned and is in critical condition. His passenger was killed.

The pilot was not the builder of the VariEze. He had recently purchased the airplane and had his instructor with him to help him get comfortable in the aircraft. It was only his fourth flight in his newly acquired airplane. The FAA has not concluded their investigation as yet but at least for now, it does not appear that there was anything amiss with the airplane.

A VariEze crashed in Southern California recently and both occupants were killed. There was one eye witness who reported observing the VariEze performing some aerobatic maneuvers before it abruptly lost power and fell to the surface of a wet salt pan. The VariEze hit the surface essentially flat with little or no forward motion and was inverted. These very unusual circumstances called for a full investigation. Two representatives from RAF assisted the FAA in trying to determine what might have caused this tragedy. The investigation team was forced to use a helicopter to examine the crash site since it

was not possible to walk across the muddy salt pan which was many feet deep in places.

It was obvious from 300 feet above the crash site that the VariEze had impacted inverted, with little or no forward or lateral velocity. This was evidenced by the mud splash marks radiating out from the center of impact.

The RAF representatives returned to the crash site several times over the next three days and many photographs were taken, and there was much discussion and theorizing. While the exact cause may never be known for absolute certain, it is our belief, based on our knowledge of the VariEze design as well as our previous experiences examining several crash sites somewhat similar to this one, that this aircraft fell essentially vertically onto the surface of the salt pan. It struck the salt crust in a nose low, wings level, but inverted attitude. There was no evidence of a spin, no sign of rotation at the time of impact. The engine was not developing power and, most probably, was not even windmilling.

Two of the the eight large wing attach taper plugs were missing. We believe they departed the airplane in flight, as did the AN-4 bolt and nut that secures them in place. When the remaining six taper plugs were removed, they were easily removed without having to drive them out. All three AN-4 bolts had had the length of threads increased to about 3/4" using a threading die to cut these additional threads. All three bolts showed evidence of elongation of the threaded area where they had stretched possibly due to being over-torqued.

We theorize that possibly the fourth bolt was over-torqued to the point of failure, or almost failure. During this last flight, and probably aggravated by the acrobatic maneuvers, this bolt failed. None of the taper plugs fitted very well into the tapered holes in the wing fittings. For this reason, we believe that the two forward plugs on the left wing worked their way out of the tapered holes after the bolt broke, thus allowing the left wing to pivot aft on the aft two tapered plugs. There are marks on the left wing attach fittings which clearly show that the wing pivoted aft as much as 15 degrees.

The wing swinging aft by itself would not have caused this accident, however the winglet mounted on the end of the wing swinging 15 degrees left would create a powerful yaw with perhaps four times the authority of the rudder alone. Such a huge yaw angle would immediately drive the aircraft into a drastic departure from controlled flight. The airplane would flip over and experience heavy negative "G" forces which would cause the engine to starve of fuel, whereupon it would quit.

Apparently, this tumbling departure occurred at a rather high speed because the enormous negative, as well as positive "G" forces overstressed the aluminum wing fittings as evidenced by the considerable elongation of the taper plug holes in the outer plate, both top and bottom, of each wing. The inner plates of each wing fitting, top and bottom, showed much less evidence of elongation,

leading us to conclude that the home made taper plugs did not perfectly fit into the tapered holes.

It is probable that the left wing, swept aft, may have caused the airplane to fall in a somewhat stable inverted spiral (as described by the eye witness). Flight experience and NASA testing have shown that a normal VariEze cannot maintain an inverted developed spin.

There is no evidence to suggest that there was any inflight structural failure of any composite parts. Every single part of this aircraft (with the exception of the two wing attach taper plugs and the securing bolt) were found at the impact site.

IMPORTANT

All VariEze builders and flyers should be aware of the seriousness of this situation. If you know of anyone flying a VariEze who may not be receiving the Canard Pusher, please pass on the following critical information:

1) A mandatory inspection of the long AN-4, 1/4" diameter bolts and nuts that secure the steel tapered plugs into the wing fittings. There are four (4) of these bolts, each must be removed and carefully examined for any evidence of over-torquing (stretched threads, necked down diameter anywhere on the length of the bolt). Double check to see that the threads on each bolt are not bottoming in the threaded lower taper plugs. You may have to use thin shim washers under the head of each bolt to assure a proper fit with no bottoming of threads. Check that the jam nuts have at least 1-1/2 to 2 threads showing after they are tight. If you purchased your VariEze wing fitting from Ken Brock Manufacturing, you will notice that the AN-4 bolts have a longer

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than standard thread. These threads as they are on any AN bolt are not cut threads, they are rolled threads. If you see any evidence of the threads having been cut with a threading die, discard them and install new bolts.

Look for any corrosion on these bolts. Any corrosion should be carefully cleaned off and the bolts should be greased before re-installing them. Excessive corrosion is cause to discard the bolts.

If you did not personally install the bolts, you may have to assume that they might have been over-torqued. Any suspicion of over-torquing is cause to discard these bolts.

If your wing attach fittings were not manufactured by Ken Brock Mfg., you will need to carefully inspect the tapered plugs for perfect fit in the tapered holes. If in doubt, you may have to carefully lap each plug into its tapered hole, checking for perfect fit with engineering blue. Check to be certain that the tapered plugs do not go too deeply into the tapered holes. The top of the plugs must not go below flush with the top of the wing fittings.

The design of a wing fitting such as the VariEze calls for the tapered steel plugs to take all flight loads. The AN-4 bolts should never see flight loads. All they are for is to retain the tapered plugs. If the tapered plus are a perfect fit, these bolts will require only a very light torque to snug the plugs into their respective holes. Three (3) foot/lbs. (36 inch/lbs.) of torque are all that should be required. If you need more torque to pull the tapered plugs into their tapered holes, your tapered plugs do not fit correctly. Do not fly until you have corrected this situation.

Two people have died because of improperly fitting wing attach taper plugs. Do not take this lightly. Your life depends on these wing attach fittings. You owe it to yourself and your passengers to do absolutely the very best work you are capable of here. This is especially true if your wing fittings are homemade. The Brock fittings are very accurately machined and all the tapered plugs are hand lapped and fit perfectly.

Once you have installed a pair of tapered plugs and torqued the bolt (3 ft./lbs), as a double check, remove the bolt and check for a tight fit of each taper plug. It should take a sharp blow with a wood drift to loosen each plug. If the plugs fall out or are not tight, they do not fit correctly. Fix this problem before next flight.

PLEASE NOTE NEW FORMAT

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION
VARIVIGGEN Check engine control cables for secure attachment at the engine as well as at the throttle quadrant. Install springs to guarantee that carburetor controls fail safe.

VARIEZE MAN/GND Ground your VariEze until you have completed a full and careful inspection of your wing attach fittings, taper plugs, and AN 4 bolts as described on page 10 of this CP. The engine control cable check as called out for the VariViggen applies equally to the VariEze.

LONG-EZ The Long-EZ wing attach method is completely different from the VariEze and there is no mandatory inspection or concern for Long-EZs in this area at this time.

The engine control cable check called out for the VariViggen applies equally to the Long-EZ.

DEFIANT The wing attach method on the Defiant is essentially the same as the Long-EZ and there is no concern or mandatory inspection for Defiants in this area at this time.

The engine control cable check as called out for the VariViggen applies equally to the front and the rear engines and quadrants of the Defiant.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For

this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

FOR SALE

Items from salvaged VariEze. Wheels, Brakes, Canopy, instruments, radios, etc. Send #10 SASE for 3 page listing:

Jim Eggleston
2602 Elnora Street
Wheaton, MD
20902-2706

Marvel Schebler carburetor for Lycoming 0-235. MA3PA complete with throttle pump. Good condition. Contact:

Bruce Tifft
3850 Sherrod Rd.
Mariposa, CA 95338
209-742-6743

I have a factory brand new Lycoming 0-235-L2C still in the crate. Zero time, complete with mags, ignition harness, starter, flywheel/ring gear, and carburetor with throttle pump. $16,000.00 outright. Contact:

Kurt Daentz
818-798-8786

Stewart Warner oil cooler #8406R - $100.00.
4" prop extension for SAE-2 (used only 10 hours) - $200.00. Call:

Joe Hill
602-299-0733 (H)
602-529-2272 (W)

SHOPPING

Cockpit vent doors for Long-EZ and VariEze. $8.00 each. EZ to install - work great. Nose wheel fenders (help keep rocks off your prop) made from glass and aluminum. Ready to paint and install - $40.00 each. Gene has had these products for sale now for over 7 years and is not sure how long he will continue to supply them. Do yourself a favor and get them now. Contact:

Gene Zabler
48 Robin Hill Dr.
Racine, WI 53406

To make it easy to install the new fuel boost pump with 37 degree flare fittings use a 90 degree elbow with 37 degree swivel nut and 37 degree flare. The Aeroquip part #2071-6-6S is for use in tight corners. Bill Bainbridge of B&C Specialties has promised to keep these in stock. This swivel elbow makes installing the fuel boost pump a simple proposition. Bill Bainbridge, of course, still sells his LR-2 Linear voltage regulator (the very best we have seen) also, dry-fit sealed, immobilized Electrolite batteries. Mike and Sally use two of these (small 15amp/hour) for their 28v Long-EZ. Burt uses two of the same

for the 28v Catbird. These have been in continuous use for two years and have been flawless. Contact:

B & C Specialty Products
Box B, 518 Sunnyside Ct.
Newton, KS 67114
313-283-8662

Wicks Aircraft and Aircraft Spruce both stock the recommended Cherokee-type fuel valve, part #6S122. This is the best fuel valve we have seen. It incorporates a cylindrical valve turning in a hard anodized aluminum body. (It does not use a tapered valve which sometimes stick.) The seal is accomplished with "O" rings which can easily be replaced by removing a snap ring. There are two large "O" rings, Part #MS29513-114 and two small "O" rings, Part #M83248/1-011. A synthetic silicone base lube should be used such as Dow Chemical's DC-4 grease.

We have received many enthusiastic reports from builders and flyers who have installed this new aircraft quality valve and RAF heartily recommends it. We only wish this valve had been available when the Long-EZ was first developed! It would have saved a lot of confusion.

"The Aero Electrical Connection", a homebuilders guide to the design and construction of aircraft wiring and electrical systems. This publication, a newsletter that, unfortunately, comes out rather infrequently, is positively the best source for anyone trying to wire up a homebuilt aircraft. It is especially good for those of us who are trying to complete plastic airplanes such as EZ's, Defiants, etc. Bob Nuckolls is an extremely

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knowledgeable electrical wizard who can and will answer your questions and help solve your problems. The newest newsletter, Volume 1, #2 has an excellent schematic wiring diagram in it, specifically for composite aircraft using an alternator and starter. Contact:

The Aero-Electrical Connection
PO Box 12703
Wichita, KS 67277-2703
Subscription is $20.00 per year.

PROPS FOR EZ'S AND DEFIANTS
RAF recommends the following prop manufacturers:

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

Bruce Tifft
B&T Props
3850 Sherrod Rd.
Mariposa, CA 95338
209-742-6743

Great American Propeller Co.
1180 Pike Lane, #5
Oceano, CA 93445
805-481-9054

RAF has received feedback from a number of builders who have had difficulty getting a prop. We contacted our recommended prop suppliers and all of them are having varying degrees of difficulties obtaining quality wood or wood blanks. Our best advice concerning props is to pick out a supplier you like and place an order at least 4 months before you think you will need it. You can always store the prop (store it level, not vertical). If you don't have one and can't get one, and you have your airplane complete and ready to fly, it could be very frustrating.

FEATHERLITE, INC., LARRY LOMBARD'S AND Michael Dilley's composite company, producers of the prefab composite parts for EZ's, Solitaires, etc. announced that they are currently working on a NACA inlet cowling kit for the Long-EZ. This will be similar to Mike and Sally's N26MS which has a 12" wide NACA flush inlet. The cowling will have the NACA lip mounted on it.

Michael and Larry have one set only of Defiant pre-cut foam cores. Also, one set only of prefab Defiant fuselage bulkheads, plus a few other bits and pieces. First come, first served. Call:

FeatherLite
707-895-2718

DEFIANT NEWS
Don Jakusz reports the first flight of his new Defiant, N86DJ. First flight was August 23, 1989 at Albuquerque, NM. Don's makes 17 Defiants now flying that we know of at RAF. Congratulations, Don.

SANTA MONICA AIRPORT
We were recently at the Santa Monica Airport in the Los Angeles basin and were amazed to find no less than 12 Long-EZ's based there, all flying and at least 4 more under construction! Talk about a hot bed of composite activity. There is also a beaufiful new museum on the airport. Some magnificent airplanes are on display there including a pristine Supermarine Spitfire MK1X. This museum is in a brand new 3 story building which also contains the DC-3 restaurant, an excellent spot for lunch. If you are in the area, don't miss this airport, it has lots and lots of interesting airplanes. See Sport Aviation, August 1989 for more details on this museum.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680

707-895-2718 714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

David Orr's Long-EZ sporting one of Klaus Savier's "Hershey Kiss" spinners.

What is Marshall Gray painting?! Actually 2 planes - Herb Abrams Solitaire and Charlie Gray's second Defiant.

Sam Kreidel's nifty battery access door. It is held shut by two small camlock screws. This is Sam's second Long-EZ and this one is something pretty special!

Joe Stevens getting some stick time in his Defiant in his yard in Terneuzen, Netherlands. Go for it, Joe!

Scotty and Karen Maddox' Long-EZ. Looks like a real beauty!

Ron Sweet's snappy looking new Long-EZ - first flight, August 31, 1989. Congratulations, Ron, looks great!

Herb Abrams better half, Ruth, sanding their Solitaire. This one has now made its maiden flight and we are looking forward to a detailed pilot report. Herb has designed a very clever power pack that should provide excellent climb.

Pete MacCauley from Canyon Country, CA. First flight of his good looking Long-EZ, N8EZ, at Camarillo, CA.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

This is the one to beat! The fastese VariEze on the planet - John and Sally Chambers' absolutely exquisite VariEze. Powered by a Lycoming O-235, John has got this VariEze about as aerodynamically clean as it is possible to do. John and Sally hail from Boise, Idaho and John has been unbeatable in his class at the Jackpot and Wendover races.

Don Foreman is installing this prefab landing brake on the belly of his Defiant. He made it off the airplane and will simply tape it in place. We look forward to a report on the performance of this drag device.

We started building in November 1986 and have about 1300 hours on it. The fuselage is on a rotisserie on a 90 degree bank to make the motor mount layups easier. I have not heard of anyone doing this before, but it seemed like a good idea and certainly makes turning the airplane over easier. The trunnions are made from 3" PVC pipe and the pedestals are 2 x 10's. There are 4 holes in each pedestal to allow different

heights, with the top hole just high enough to allow the spar to clear the ground. This height also allows the plans-built benches to be used to chock the fuselage. One person can easily rotate the fuselage, but it takes two to raise or lower it.
Dan and Kay DeLong
Toney, Alabama

Arthur Schwartz' beautiful VariViggen. This is how it looked before he was forced to land in the Piconic Bay.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Mike and Sally arriving at Oshkosh in N26MS the day before the show opened. The huge Russian AN-124 kneels, nose down, for "EZ" access. Interestingly, this was one of two non-military, privately owned, AN-124's. They operated all over the world as a free enterprise freight hauling business.
Photo by Ann Cooper - Ann is an aviation writer who also takes beautiful pictures.

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THE CANARD PUSHER No. 62 Oct 89

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 62.
VariViggen (2nd Edition), newsletter 18 to 62.
VariEze (1st Edition), newsletters 10 thru 62.
VariEze (2nd Edition), newsletters 16 thru 62.
Long-EZ, newsletters 24 through 62.
Solitaire, newsletters 37 through 62.
Defiant, newsletters 41 through 62.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 AM TO 5:00 PM ONLY. If you have parts that you would like us to see and/or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come other than those days, please call so we will be sure to be here. When you call on Tuesdays and Fridays for builder assistance, please give you name and serial number. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

DEFIANT FLYERS
John Steichen has just completed the installation of a S-Tec System 50, two axis auto pilot in his Defiant and reports that he is very pleased with it. He did have some problems getting it to work correctly in the Defiant, but thanks to the excellent support he received from S-Tec, and his own ingenuity, he has it working very well now. He has used it in the world of radar vectors and reports that the heading-hold feature is a real joy.

We can verify all he has said about S-Tec. We, at RAF, installed the same System 50 auto pilot in Burt's Catbird and it is a wonderful piece of equipment. John Steichen says he would be willing to help other Defiant flyers who may be having problems installing an auto pilot. John lives at 960 86th Street, Downers Grove, IL 60516. John has filed

IFR several times now in his Defiant and says it is a gem. On two occasions, John has encountered very light rime ice and has found that his Defiant requires a very mild change in pitch trim due to the ice accumulation.

Burt has encountered light rime ice on several occasions in N78RA and his recollection was that the trim change was so small that he saw no need to retrim. There are at least 17 Defiants flying as of January 20, 1990.

CENTRAL STATES ASSOCIATION
Please note that the Central States Newsletter/editor has a new address. Arnie Ash has retired and passed on the editorial responsibilities to Terry Schubert.

New members are encouraged to join Central States and receive a quarterly newsletter and attend the annual flyin. Membership is $15.00 -
Contact: Terry Schubert
9283 Linbergh Blvd.
Olmsted Falls, Ohio 44138

CORRECTION
We regret that we incorrectly identified Long-EZ VH-HGS in CP59. The owner/builder of this beautiful Long-EZ is Henry Schultz of Glengowrie, Australia. Henry bases his plane at Murray Bridge. He and his Long-EZ took top honors at the National Sport Aviation Fly-in in Australia in 1988 as well as in 1989. The Concourse D'Elegance Award, the equivalent of Grand Champion, was awarded for Best Amateur Built in 1988 but covered all categories, Warbirds, Ultralites, Amateur Builts, Etc. in 1989. Congratulations, Henry - Sorry we goofed!

OVER-HEATING OF ENGINE ACCESSORIES
Such as magnetos, voltage regulators mounted on the upper firewall, etc. An EZ's updraft cooling system does indeed cool the engine accessories while in flight. The lower side and accessory case end of the engine are immersed in cold air in flight. When you stop and park nose down after a flight, the air surrounding the engine and accessory case is trapped between the firewall, the accessory case and the top cowling. The temperature of this air, rapidly increases to as high as 350 degrees F or even 400 degrees F - try it yourself - use a "template" stick-on temperature indicator, stick it on a magneto and go fly. Park it for a few hours, then pull the top cowl and read the "template". You may be surprised, even shocked!

The Slick Magneto people have told RAF that the Slick mags will break down and probably have premature failure of the high tension coil if the temperature of the mag gets much over 300 degrees F!

How to fix this problem? You could do what Mike has done on N26MS. He installed his oil cooler on the firewall and exits the cooling air through the oil cooler and out of the top of the cowl. This is not the best spot for an oil cooler, (his oil runs between 190 degrees F and 210 degrees F) but it did achieve something else, it allowed hot air in

this area to "chimney" out through the oil cooler and top cowling. Hot air rises, cold air comes in through the intake on the bottom of the fuselage and, presto, you have cool magnetos and anything else you may have mounted in this area. Mike's magnetos have never gone over 175 degrees F during the past 600 hours of flight. We are not necessarily suggesting moving your oil cooler - so what else can be done? A "drop in" door could be installed. While we at RAF have never done this to a Long-EZ, we certainly have on several other airplanes and they work well. A "drop in" door is a door hinged with the hinge running parallel to the aircraft centerline. The door is made like your oil check door, but it opens into the cowling. It must be restricted from opening more than 15 to 20 degrees. It does not have a latch or spring to hold it open or closed. It opens by gravity when parked or taxiing but it will close when you take off and fly due to high air pressure in the cowling. If you have very high temps on your mags, or you have had premature mag failures, you may consider such a door. If nothing else, try opening your oil check door when you park, but PLEASE don't forget to close and latch it before you take off!

CAUTION
Seal your fuel tanks with a generous coat of Safe-T-Poxy before you close them out. (Two coats is even better). Do not neglect to paint at least two coats of epoxy inside the sump blisters before you install them. They will certainly leak if you don't.

FUEL LINE BLOCKAGE
This has been a CP subject before, but we continue to receive reports of fuel line contamination. Listen up, People! A fuel line blockage may, at the least, cause a forced landing and at the worst, kill you. Foam chips, fiberglass shards, pieces of micro falling into your fuel tanks when you install the fuel caps, can work their way into the fuel lines and we have even heard of them getting all the way to the fuel valve and jamming the valve! How about that for a problem! Check your fuel lines for obstructions before first flight. Check them again after 50 hours and thereafter at each annual inspection. A fuel line or valve blockage is a very serious problem.

RE; WHEEL BALANCING ARTICLE IN CP 61
George Lyle sends in the following hints to enhance safety when installing sticky-backed weights in your wheels:

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1) Make sure that the mounting location is absolutely clean - use MEK and a paper towel, wipe several times until paper towel is clean. Brake residue makes it difficult for the adhesive to grip, and a lead weight in the brake caliper would not be too neat!

2) Bend the lead weight to match the curvature of the wheel - allows 100% contact for the adhesive.

3) Use lead weights with the thinnest adhesive foam tape for best results.

Thanks, George.

MORE ON SPIN-ON OIL FILTERS FOR CONTINENTAL ENGINES.
Richard Cobean sent in a copy of the paperwork for an STC'ed spin-on oil filter adapter that bolts directly onto the side of the crankcase of Continental engines, C-75, 85, 90 and 0-200. The model TAF oil filter adapter uses a Champion CH-48108 or an Electro Systems ES-48108 filter. This filter adapter comes complete with a comprehensive set of instructions and all applicable gaskets. The filters are commonly available at most FBO's. Richard Cobean obtained his from: El Reno Aviation, Inc.

PO Box 760
El Reno, OK 73036
405-262-2387

LORAN ANTENNA INSTALLATION
Although this subject has been covered in several CPs, RAF continues to receive requests as to what is the best or latest on Loran antennas. Well, this will hopefully be the last word on the subject.

This is a description of my Loran antenna installation on Sally and my Long-EZ, N26MS. There are at least two other Long-EZs flying with exact copies of what we did and all three have excellent Loran reception.

Right or wrong, I firmly believe that a Loran antenna must be outside the fiberglass skin of the airplane to work correctly. Sure, you can point to many installations in winglets, down gear legs, even in canopies that "work". They may work, but believe me, they do not give maximum performance to your Loran. If you intend using your Loran as Sally and I do, a primary means of navigation all over the USA, you should attempt to get the maximum performance available out of the antenna. After trying every antenna suggestion that has been in the CP, I have convinced myself that the antenna needs to be out from under fiberglass/epoxy skins. (Just as transponder antennas do). I believe the glass/epoxy skins attenuate the signal to some degree, thus compromising the performance of the antenna and worse yet, this compromises the performance of your Loran. It does not matter how cheap or how expensive the Loran, a poor antenna will a poor Loran make!

I took a hacksaw blade and cut the rear seat thigh support out flush with the floor of the rear cockpit. Since we have a flush NACA engine cooling inlet centered in the bottom of the fuselage, I decided to offset the antenna from the centerline so as not to compromise the NACA inlet's efficiency.

First things first. I believe to get the best out of a Loran (or a transponder) you should use the antenna supplied and matched by the manufacturer. Anything else will be a compromise. So I used the antenna pre-amp (a small aluminum box of magic that amplifies the incoming signal which in some locations can be very, very weak) as supplied by the manufacturer, in this case Northstar. Incidentally, I have flown ARNAV, Apollo and Micrologic Lorans and none compare to Northstar's M1 for overall performance, user friendliness and features in my opinion.

I cut through the floor of the rear cockpit where the thigh support would cover and protect the antenna and coax cable. (See sketch)

Using a Dremel, I kept grinding away until the antenna could be installed from inside the cockpit, through the floor, so that the base of the antenna was perfectly flush with the inside glass skin of the cockpit floor. I then made an aluminum plate to match the base of the antenna. I sandwiched the ground plane (copper screen) between the base of the antenna and this aluminum plate. I applied a generous coat of DC4 grease to the aluminum base and plate prior to tightening the

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three bolts. This grease prevents arcing and corrosion of the aluminum and assures long term excellent electrical contact between the copper screen ground plane and the antenna base. I used exactly the same method to install the antenna pre-amp to the ground plane.

The ground plane (without which this type of antenna simply will not work at all!) is a single piece of copper wire cloth 16x16 mesh with .011 copper wire diameter. (I got it from McMaster-Carr, their part number is 9224T22, phone in LA, 213-692-5911, approx. $3.00 per square foot). I cut it to fit the rear cockpit floor from the back of the front seat bulkhead to the forward face of the rear seat bulkhead and from the left side to the right side. The bigger the ground plane, the better.

I simply micro'd the Northstar bent whip antenna into the hole I had made. You could use silicon or you could figure some way to make it removable but I don't think it would be worth the time and effort. If mine ever dies, I will just cut it out and get another one.

My antenna is about 2-1/2" left of the aircraft centerline and the antenna pre-amp is on the right side. Both are under the rear seat thigh support such that the highest point of the thigh support is directly over the BNC connector on the base of the antenna. This gives the most possible clearance for the RG-58 AU antenna coax cable.

Now, the most important part of all. You must run a separate ground wire (I used 18 gage) from one bolt on the pre-amp to one bolt on the antenna base. Then from there, directly to a bolt installed in the side or end of the mounting tray for the Loran unit. From this bolt, you should run this ground wire directly to the negative terminal of the battery. If you neglect to follow this grounding procedure exactly, you will have a compromised, possibly ineffectual antenna and thus, Loran. This separate ground is the key to a really successful Loran installation in a plastic airplane. There is no need for any other ground plane wires. There is no need for any electrical connections between metal parts on the airplane. It is possible that these two features may not hurt the Loran installation, but I do not have these features on N26MS and I have optimum reception, both signal strength as well as signal-to-noise ratio. A factory installation in a certified metal airplane does not get any higher numbers than I do in the same geographical locations.

I layed up one ply of BID over the copper screen both to protect it and to hold it firmly in place. The best possible way to install this would be to vacuum bag this ply down onto the floor, but I did not do this. I then micro'd the rear seat thigh support back into its

original position and taped it down with one BID tape. I finished the rear cockpit floor area with charcoal gray Zolatone to match the rest of my interior.

Obviously, the antenna coax (RG58AU) must be installed per the manufacturers instruction. Be very conscientious about installing the BNC connectors to this coax cable, or better yet, have a competent radio shop do it for you.

I installed my Northstar as high as possible in my instrument panel because I use it as a primary navigation instrument and I believe it should be as visible as possible to the pilot while he is looking out of the canopy (as near as you can get it to a head-up display {HUD}).

Mike Melvill

SHOPPING
Debbie Iwatate's EZ ideas book is still for sale - still costs only $20.00 and you can get one from Debbie at her new address:

1699 April Loop
Richland, WA 99352
509-943-9579

This little book contains plans, done EZ-style, for forward mounted brake master cylinders, a nifty roll trim system, and other neat little ideas that Debbie and Ken came up with while building their excellent example of a Long-EZ.

Hinge Pin Kit - Teflon tubing and high grade stainless steel hinge pin material - enough for ailerons and rudders on any VariEze, Long-EZ or Defiant.
Kits for VariEze or Long-EZ - $21.00 ($25.00 overseas).
Defiant - $23.00 ($27.00 overseas).

Contact: Gary Hall
851 SW 63rd Ave.
North Lauderdale, FL 33068
305-971-9731 (H)
305-974-6610 (W)
Please identify yourself as an Experimental Aircraft builder if calling at work.

We mentioned, in CP 61, Gary Hertzler's spin-on oil filter design. Unfortunately, we called out his old address! OOPs! Please contact Gary at:

Gary Hertzler
2622 S. Iglesia Crescent
Mesa, AZ 85202

High Performance Antistatic Wax.

Appropriately named Zerostatic, this new product was developed by EZ builders for EZ's and it is excellent. You can wax your entire

aircraft, including the canopy, and it will greatly reduce dust build up while parked in the hangar. It is a gel that is easily applied and, best of all, it reduces electrostatic buildup - meets mil-B-8170C specifications for static decay. As an example, a Long-EZ fuel strake, treated with Zerostatic gel and polished with a high speed orbital power buffer, will have essentially no static buildup. Try it, then place your forearm in close proximity to the strake. The hairs on your arm will not react with Zerostatic, but will stand up and tingle with any other wax. Should help reduce the risk of static discharge while refueling.
Wicks & Spruce have this new product in stock. Give it a try.

Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set
Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 93501
805-824-2645 (Tues. & Fri. only)

Nose Gear Crank Getting Loose?

Curt Smith may have just the thing for you. He uses the ratchet out of a Craftsman socket drive to hold the gear in the up, as well as in the down, position. Since the little gear inside the Craftsman socket drive must be annealed, machined than reheat treated, he is offering to do this and will sell you one, ready to install for $29.95. This has been an area of concern for several years and many ideas have been tried by many different people. The ratchet holds the gear handle firmly all the way gear up, then, flip the ratchet lever and the same ratchet holds the gear handle firmly in the gear down position - sounds great, wish we had thought of this years ago!
Send $29.95 to: Curt Smith
5114 Canaan Center Rd
Wooster, OH 44691
216-345-6571

Canard Pusher Digest - Stet Elliott's Canard Pusher Digest for the Long-EZ is still available. The Canard Pusher Digest is basically a recompilation of information from CP24 - CP61 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, See CP57). Note that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

CP Digest for the Long-EZ $67.00
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel.
Annual Update subscription $25.00

(4 updates)
Overseas orders add $5.00 for
postage.
Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

FOR SALE

Lycoming 0-235-L2C, 350 hrs. SMOH. Presently running in my Long-EZ - $6500.00
Contact: Peter Simmons
219 Pendelton Hill Rd
North Stonington, CT 06359
203-535-2040

Lycoming 0-235-L2C, 703 hrs. TTSN, with logs. Zero hub runout, chrome cylinders with new steel rings. New Slick mags and harness. 30 amp alternator with regulator, starter, carb with intake system. Baffles, oil cooler, boost pump, vacuum pump with regulator. 4" prop extension with crushplate and prop bolts, polished spinner for Great American prop. All out of a Long-EZ - $5200.00. Write for a list of miscellaneous instruments and new Terra radios, Apollo 612B Loran, etc.
Contact: Richard Dean
777 Bocage Lane
Mandeville, LA 70448
504-845-3648

Lycoming 0-235-L2A, 1188 TTSN, with mags, carb, alternator, fuel pump, starter, oil cooler, etc. $2750.00 or best offer.

Continental 0-200, 100 HP, 248 hrs SMOH, with mags, alternator and carb. $3200.00

Also miscellaneous parts and accessories for EZ's.
Call for list: Don Bates
2742 Swansboro Rd.
Placerville, CA 95667
916-622-1886 (H)
408-365-5541 (W)

Attention European CP Subscribers

Lycoming 0-235-C2C, 1482 TTSN, - $3000.00.

Lycoming 0-235-L2C, 362 TTSN, Zero STOH, preserved, no corrosion.
$7000.00

Also some 0-235 engine accessories, King KX-175/KI 208 and KT 78.

All above are located in West Germany. Contact:

Norm Howell
Mulchenstrasse 1
5506 Zemmer
Bundes Republik
Deutschland

Lycoming 0-235-L2C with 24 volt starter and alternator, mags but no carb. Run out, $2750.00.
Contact: Dan Kreigh
Hangar 78 - Airport
Mojave, CA 93501
805-824-4541

Carbon Fiber reinforced wood prop for Lycoming 0-235, made by Klaus Savier. 65 hrs. TT. Increase your cruise and climb.
Contact: Dale Martin
602-776-8950

Functional Compu-Cruise. Ready to go - complete. $200.00.
Contact: Mel Hinson
512-651-5086 (H)
512-828-0551 (W)

WANTED

One canopy/gear warning system by Ian Ayton.
Contact: D. Lind
619-755-6117

Need at least 8 VariEze wing attachment pins.
Contact: Bruce Wiltse
26952 Messina St.
Highland, CA 92346
714-862-4029

Dear CP,

I need help. My son is trying to build an autopilot for my Long-EZ based on a Sport Aviation article by Doug Garner - (1980).

Unfortunately, the thermistors required are only available in large quantities and large cost ($800.00) in Australia. The thermistors are: Fenwall GB 32-L1, may be superseded by Fenwall 112-202-EAJ-H01.

I would like to hear from anyone who may have built Doug Garner's autopilot and from anyone who may be able to sell me 2 to 10 of these thermistors.

Sincerely,
Jim Glindemann
34 Milford Crest
Frankston, Vic, 3199
Australia

TRADE
Run out 0-320-H2AD Lycoming for 0-235-L2C (can be run out).
Contact: Jacque Elliott
512-425-8913

PLEASE NOTE NEW FORMAT
PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

VARIVIGGEN VARIEZE LONG-EZ DEFIANT	MAN/GND	Each time you remove your cowl for routine maintenance, carefully inspect your exhaust system using a bright light. Pay particular attention to the weld at the flanges. Sometimes small cracks develop in this area and they are difficult to see. Exhaust systems should be carefully inspected at least every 50 hours.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

PROPS FOR EZ'S AND DEFIANTS
RAF recommends the following prop manufacturers:

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

Bruce Tifft
B&T Props
3850 Sherrod Rd
Mariposa, CA
209-742-6743

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

ACCIDENTS AND INCIDENTS
A VariEze crashed soon after takeoff in Aspen, Colorado. The pilot and passenger were both killed. Engine failure is suspected. The damage to the prop is such that the engine was not running when it crashed. The FAA has not officially come up with a probable cause for this accident, but their investigation is looking seriously at fuel exhaustion or, at least, a fuel stoppage as being the likely cause. This VariEze had been flown for at least 3-1/2 hours since the last time it was known to be refueled. Depending on the power setting and fuel tank capacity, this is very close to enough to have used a full tank of gas.

At the last known refueling, this VariEze was refueled while parked nose down. Also, the pilot did not supervise the refueling, rather, the line boy was told to fill it up.

First of all, it is not possible to completely fill the fuel tanks of an EZ while parked nose down. If for some reason you require all the fuel you can get, top if off in the 3-point position. Second, we have had it happen to us, that a line boy failed to top off an EZ fuel tank when using a very high rate of fuel flow due to the baffles in the tank

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causing the tank to momentarily appear full. Some refueling trucks and pumps have more flow capacity than the baffles in the fuel tank can allow the fuel to drain to all corners of the fuel tank. Don't forget this fact if you absolutely need to have the maximum fuel for a long trip. Most important of all, remember it is the pilots responsibility to check how much fuel he or she has onboard, not the line boy's. On a VariEze, built per plans, you have a 2 gallon-plus emergency reserve fuel tank in the area above the centersection spar forward of the firewall. Don't forget to check the level in this tank and to fill it if necessary. This is a get-you-home fuel supply, but it will do you no good at all if it has been used or has drained through a leaky fuel valve into the main fuel tanks. Keep this tank full, always - it could save your bacon.

We have just received a telephone report of an engine compartment fire in a Long-EZ just after it landed. The fire was apparently caused by a Sport Flight exhaust system failure. Although exact details are not known at this time, the exhaust header broke for some reason and allowed a hot jet of exhaust gas to impinge on the cowling which caught fire.

Fortunately, this occurred on the ground and a good quality Halon gas fire extinguisher was available to put out the fire - damage was confined mainly to the cowling.

An exhaust system failure in any aircraft is cause for serious concern. Theoretically, if the pipe breaks off in flight it should not cause an immediate fire due to the high speed air being forced through the cowling and "drowning" the fire. However, as you slow down, like on a

landing roll, this feature gets to be less and less of a factor and a fire can result.

If you hear a sudden, much louder than normal engine noise, assume you have a problem and that it could be a broken exhaust. Head for the nearest airport but keep your speed up. Land as soon as practical and consider killing the engine as soon as you touch down.

The EZ flyer who called in this report promised us a detailed report on what happened once he has had a chance to really look into it. We will report it to you in a future CP.

A Louisiana Long-EZ crash-landed on its first flight. The pilot was not injured. Although we have very sketchy data on this incident, as is our policy, we are publishing all we do know as we do on all accidents and incidents we hear of.

Apparently the pilot got behind the airplane on final, got too slow and developed a high rate of sink. The airplane hit hard failing the gear, slid along leaving the runway and flipping over. The winglets were broken, one wing was ripped off and the canopy was smashed. The head rest broke off, but incredibly, when the airplane was lifted, the pilot had only minor cuts and bruises.

As with all accidents and incidents reported in the CP, the only reason we print them is to hopefully help someone else and maybe prevent a similar situation by being forewarned. There is no intention of judging a pilot or his or her actions.

What can we learn from the above accident? Although our own records do not show it, the FAA says that a high percentage of accidents in homebuilts occur on the first flight. This is one that did. There is no question that the sight picture out of the front seat of an EZ on final, is not like anything the average low time private pilot may have seen. It is unlikely that he has ever sat on the aircraft centerline before. The EZ must be set up to land a little differently than the "standard" Cessna, Piper, etc. In fact, it is much closer to a modern jet fighter in some respects. There is no prop in front of the pilot, the airplane does not pitch nose down as a Cessna or other single engine certified airplanes do when flaps are lowered, and it does not have to be rounded out or flared when close to the ground as a Cessna does. Rather, the landing attitude is set on 1/2 mile final by simply slowing to 80 or 90 knots. The landing brake creates no lift, no pitching moment as flaps do, all it does is provide drag to steepen the glide slope a little. The nose high attitude necessary to land is strictly a function of airspeed. Slow to approach speed and the airplane will automatically set itself to the correct touchdown attitude. Now, simply fly it

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onto the runway. When you have 20 to 50 landings in your log book, you can finesse the touchdown with a tiny flare, but for the new EZ pilot, this is not necessary or desirable.

Because of this "difference" in an EZ, whenever it is possible, always try to get at least a back seat ride in an EZ before you attempt your first flight, particularly if you don't have much flying experience. This can easily make the difference between a successful and unsuccessful first flight.

Just as you carefully, even meticulously, prepare your airplane for first flight, so must you prepare yourself if you are to be the pilot. Get yourself current and proficient in at least two different aircraft: A Grumman TR-2 and a Cessna 150 would be excellent, or a Champ or Luscombe and a Piper would be fine. The point is to be as sharp as you can be. Then find someone who will give you a ride in their EZ. A VariEze or a Long-EZ, it does not matter. Get a little stick time, maybe even fly an approach, it will make an enormous difference if you have at least flown in an EZ.

That is not to say they are difficult to fly - they are not, they are just a little different. Another thing to keep in mind is this - ANY aircraft will develop a high sink rate if you get it too slow, including canard types. Don't be lulled into a false sense of security by thinking you can pull the stick all the way back on short final and the airplane, because it is a canard, will look after you! A canard airplane is just like a conventional airplane, it must be at or above flying speed to fly. Get it too slow and a canard airplane will sink just as a Cessna or Piper will.

LETTERS

"Dear RAF;

Just a note from one of the silent EZ's. G-Emmy was built to the plans with a Lycoming 0-235, vortilons on the wings and she is used, as designed, for long range touring all over Europe. We're in our eighth year of operation now and I am pleased to report that my daughter, Emma, has recently soloed G-EMMY. (All my own work -HA!).

Many thanks for the great CP builder support over the years.

Sincerely,

Mike Tooze
England

Dear RAF;

This is to inform you of the whereabouts of Long-EZ #20, N75DD (formerly N26JD). No, it has not crashed. It still flies very well.

As of December 26, 1989, I donated it to the St. Louis Aviation Museum. Eventually it will reside with many of the old Douglas airplanes as this museum is primarily the creation of McDonnell-Douglas people. (I would have rather mounted the Long on a pedestal in my front yard but zoning laws precluded it.)

I very much appreciate that Burt Rutan shared his genius for about ten years with the grass roots pilots of the world. I, for one, will never

forget the day the Long-EZ plans arrived, and the day I first flew the airplane. I was, and am, very proud of that flying machine, none of which would ever have been possible without Burt Rutan.

Thanks to him and each of you at RAF.

Sincerely,

David G. Domeier.

Dear RAF;

My Defiant now has 350 hours on it and I've had a couple of experiences that remind me of why I built the Defiant, i.e. I've had to go single engine twice and it was a piece of cake as far as safety goes and ease of flying the airplane.

The first instance was last Spring when my rear engine broke an exhaust valve that then went thru the exhaust and splintered one blade of the rear prop. I was at gross with 4 aboard at 10,000 feet over hostile Arizona terrain and all of a sudden there was a pitch change and a slow degradation in airspeed. As I had been

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suspicious of #4 cylinder because of a wet spark plug and some "shavings" seen inside of the valve cover I was monitoring the EGT on 4 and it rapidly went from 1450 to 1200 or so and told me which engine lost power. I shut down the rear engine and turned around and flew the 20 miles back to Scottsdale uneventfully. On final, my 12 year old daughter, Sara announced that "her whole life just passed before her eyes". The point is that this was basically a no sweat situation due to the design of the plane and with fixed pitch props and 50% power on the front engine was all that was needed to get us home with a 9.000 foot descent. Now there is a learning point here - I had my cylinder checked out with an A&P professional and was told the shavings were from the exhaust valve springs wearing on a washer and that the wet cylinder was due to the ring slots lining up. What I should have done was to have pulled the cylinder and investigated further. By the way, about 6 weeks before this I'd switched from Aeroshell to Mobil 1A total synthetic oil. Aviation Consumer has an article that cautions that in engines with time on them, you may mobilize sludge and perhaps have problems. Aeroshell is designed to keep particles in suspension--guess what oil I'm now using.

The second incident occurred this Fall when I was commuting to Santa Maria from Scottsdale for a few weeks of work in my field of Anesthesia. I was coming home and 100 miles out over Lake Alamo, I started smelling smoke. I was at 11,000 feet and glad I was alone and not too happy, I shut down the front engine and the smoke smell went away. I've had a nuisance oil leak for 300 hours from my front engine and since it is updraft cooling it gets on the windscreen. I'd noticed that lately there had been some black streaks in the oil and figured that it was oil that was being carbonized from cylinder head heat. So I flew the plane on home and was only able to maintain altitude at 90

KIAS without the oil temp going plus 200 with the prop windmilling. So I stopped the prop but there was a strange air sound so I let her windmill and brought her on home and by descending to 7000 feet, maintained 110 KIAS and had adequate cooling. After investigation, I discovered 2 broken prop bolts and an almost-to-fail prop, the hub of which was charcoaled. The black streaks on the windscreen was prop wood. Now I had 40 hours on this prop from Great American and about 10 hours since retorquing to 40 ft. lbs. I almost checked the torque when I was in humid Santa Maria but decided, if anything, the wood would have swelled and therefore any checking could be done in Scottsdale. When I got the prop from Great American, the lug holes were too shallow and I deepened them with a plug cutter and flew all this time with what probably was a prop that may not have compressed all the way to the flange of my 8" extension. The second thing is that I relied on advice that grade 8 hardware bolts may be OK for prop bolts. I now question this and feel personally that the extra expense my be worth it, especially to all of you single engine pilots out there.

Other than these problems, the Defiant has been a delight to fly and the only advice to you other Defiant builders is that I would do a fixed windscreen for safety like Johnny Murphy did and would do a fixed front gear that would be similar to the Wheeler Express with a wheel pant. The speed penalty might be very small and the gear box could be done away with.

Mike, I'll be seeing you at Jackpot.

George (Best)

EDITOR'S NOTE; Grade 8 bolts have no place on an airplane, especially as prop bolts. They are much too hard and therefore too brittle. Aircraft bolts are ductile, not brittle!

CAN I SLIP MY EZ?
This is question we get here at RAF from time to time and it is a subject that has been discussed at Oshkosh during the "bull sessions".

The reason for the question stems probably from the fact that a lot of you have flown C120's, Luscombes, Champs and the other taildraggers with no flaps. As you know, the best way to lose altitude in one of these airplanes is a forward slip. In a Champ, as an example, a forward slip will cause the airplane to lose altitude dramatically, yet not gain any airspeed. Many taildragger advocates will tell you that a slip in a flapless taildragger is more effective when trying to lose altitude than flaps are on a Cessna or Piper.

What about in an EZ, though? Well, a VariEze slips quite well, that is, it will lose altitude

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readily in a forward slip. Not anywhere near as much altitude as a Champ or a Pitts. However, the VariEze has been shown to occasionally depart in a sideslip departure. In fact, RAF put out a mandatory change to the rudder travel on all VariEze's for this reason. For this reason, RAF HAS NOT AND DOES NOT RECOMMEND slipping a VariEze.

Actually, a VariEze and a Long-EZ, for that matter, will lose as much altitude as rapidly by deploying the landing brake and stepping on both rudder pedals (deploying both rudders) and slowing to around 75 knots and flying wings level.

We have done considerable testing of this fact, and a Long-EZ with landing brakes and both rudders out, flying wings level, at 75 knots will lose 1100 feet per minute. The same Long-EZ, clean (landing brake closed) in a full rudder forward slip will lose also about 1100 feet per minute. A full rudder forward slip with the brake down will generate about 1250 feet per minute rate of sink. All tests were done at 75 knots indicated, with power at hard idle.

We can therefore conclude that although EZ's can and do slip OK, there is no point in slipping them because you can do essentially as well with the landing brake, both rudders and the proper airspeed - and it is much safer since there is much less chance of a departure from controlled flight.

MISCELLANY

Bob Davenport has let us know that he will be getting out of the business of supplying his excellent nose wheel shimmy damper soon.

If you don't already have a Davenport shimmy damper, get your order in now before it's too late. As we have said before - Bob's shimmy damper is very effective and remains effective with minimal adjustment or maintenance.

Divinycel PVC foam will be light blue instead of tan in the future. Some sheet sizes will change slightly. If these size changes mean having to piece foam together, that's OK - a micro joint in PVC foam is much stronger than the foam. The new blue foam will be stocked and sold by Aircraft Spruce and Wicks.

**CARTOON OMITTED*

SKETCH OF LORAN ANTENNA INSTALLATION OMITTED

Mike Toose's daughter, Emms, on her solo flight of G-EMMY in England. GOOD SHOW! **PHOTO OMITTED**

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 63.
VariViggen (2nd Edition), newsletter 18 to 63.
VariEze (1st Edition), newsletters 10 thru 63.
VariEze (2nd Edition), newsletters 16 thru 63.
Long-EZ, newsletters 24 through 63.
Solitaire, newsletters 37 through 63.
Defiant, newsletters 41 through 63.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 12:00 AND 1:00 to 5:00 When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

REDUCED OPERATING HOURS AT RAF
As of May 1, 1990, RAF will be manned on Tuesdays only.

It has been five years since RAF discontinued selling plans and licensing builders to fabricate Burt's designs. That's a long time to support builders. RAF's bookkeeping procedures has always logged deferred income for 5 years after plans sales on the assumption that any serious builder would complete his project within that time. However, we do plan to continue, on a limited time basis, builder support. Mike's duties have become quite varied and, more and more, he is required to be at his desk at Scaled Composites. We hope we have hit upon an acceptable solution for you people who purchased plans from RAF prior to 1985 and are still busily building the flying machine of your dreams.

Each Tuesday, there will builder support of an abbreviated nature. We ask that if you have a question or problem that can be sent in, please

do so. (See page 1 of this CP). If you have epoxy dripping from your elbows, or if you have an urgent problem that requires attention within the next week or so, then Mike will attempt to return your call. This, of course, requires not only your name and serial number when calling, but also a brief description of your problem (in laymen terms, so Joan can understand and forward the information to Mike) and your agreement to accept a collect call.

Hopefully, this will still accommodate those of you who might encounter serious building problems while allowing Mike to fulfill his duties at Scaled Composites

We certainly appreciate your co-operation.

OSHKOSH TALKS
ALL OF BURT'S TALKS THIS YEAR WILL BE IN TENT #3 AT 11:30 AM.

FRIDAY - JULY 27 - TOPIC: REQUIREMENTS FOR AVIATION GROWTH.

SATURDAY - JULY 28 - TOPIC; THE COCKPIT-A DISASTER ZONE.

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SUNDAY - JULY 30 - TOPIC: ARES-THE DESIGN PHILOSOPHY AND TEST RESULTS.

RUTAN BIRTHDAY BASH
This event is sponsored by David Orr and Dick Kreidel and will be held at Lake Isabella on the Kern Valley Airport on June 2, 1990 between 10:00am and 3:00pm. All builders and flyers of all Rutan designs are welcome. Kernville is at the north end of Lake Isabella and the airport can be found on a Los Angeles sectional. Elevation is 2614" and the runway is hard surfaced and 3500 feet long.

JEANA'S BIRTHDAY PARTY
May 12, 1990 - 10AM "til ? - Oceano Airport

Sponsored by Long-EZ builder/flyers Mike & Bev Rhodes, 234 Garden St. Arroyo Grande, CA 93420, 805-489-8155. RSVP requested.

1990 R.A.C.E. SCHEDULE
May 26, 27, & 28, 1990
Kanab Canard Honk Out
Coral Sands Motel
801-644-2616

June 30, July 1 & 2, 1990
Jackpot EZ Bash
Cactus Petes*
Reservations: 1-800-821-1103

*Note - Due to hotel construction, Shirl Dickey recommends making reservations at the Horseshoe Motel.

September 1, 2, & 3, 1990
Wendover/Bonneville 125
Stateline

Reservations: 1-800-648-9668

November 24 & 25, 1990
2nd Annual R.A.C.E Kilo Trials and High Points
Championship Party
Contact: Shirl Dickey at 602-491-1548

Come on up to the beautiful red cliffs of Kanab, Utah and honk it on with all your fellow canards.

This is your first chance of the year to be the lead honker in your class.

If you're not the lead honker, the view never changes.

If you think your canard really honks, bring it to the Kanab Honk Out and show us your tail feathers!

ACTIVITY AT SCALED
Several builders have requested information on Burt's latest projects at Scaled. I have been fortunate enough to have flown the Triumph business jet as well as the Ares "mudfighter" as Burt calls it, so I thought I would give you just a taste of what these airplanes are and how they fly.

Ex-NASA test pilot, Fitz Fulton, flew the first flight of the Triumph twin jet. Since the flight card called for this flight to be done with the gear down and locked, and the speed not to exceed 150 knots, I was able to chase the little business jet with my Long-EZ! The flight was picture perfect and she looked beautiful against the Sierra Nevada mountains. This small business jet has seating for 4 to 6 passengers plus a pilot and copilot. It is powered by two FJ-44 Williams fan jet engines, each rated at 1800 lbs. of static thrust. It is designed to have a maximum cruise speed of 400 knots and a cruising altitude of 41,000 feet. The Williams engines are new, state-of-the-art, extremely fuel efficient, fan engines and are the quietest jet engines we have ever heard.

Take-off in the Triumph is quite a thrill. Generally for test purposes, we go to maximum continuous power while holding the brakes. Upon brake release, the acceleration is very impressive. You find yourself pressed firmly into the seat. Rotation normally occurs at around 70 knots and she lifts off at around 100 knots using, perhaps, 1800 feet of runway. We start the gear up soon after breaking ground and climb at more than 4500 feet per minute at 200 knots.

From breaking ground at Mojave to 41,000 feet takes only 18 minutes.

Flying qualities are excellent. Pitch and yaw controls are light and responsive, roll control is a little heavier but very powerful and the little jet does beautifully crisp aileron rolls! There have been a number of journalists who have recently flown Triumph so look for articles in "Flying," "Air Progress", "AOPA Pilot" and "Aviation Week" magazines.

Doug Shane, Scaled Composites' Chief of Flight Test, conducted the first flight of Ares and, once again, I was able to chase with N26MS! Of course, this was only possible due to the gear down and speed constraints on the first flight. The second flight had to be chased by the Triumph biz-jet! I was fortunate enough to fly the second flight and have flown a number of subsequent flights.

The Ares is a canard configuration, swept wing, twin tail, single engine jet fighter. The engine is a Pratt and Whitney JT-15D producing 2900 lbs. of static thrust. The airplane weights in at around 5000 lbs. for most of the testing done to date, so you can appreciate that she has excellent power-to-weight, and really gets with the program when you step on the gas! Take-off is really fun, full power gives dramatic acceleration and things happen very rapidly. Nose wheel lift off at 70 knots, mains lift off at 90 knots using about 1500 feet of runway. The gear comes up in 8 seconds and we climb at over 5000 feet per minute. So far, we have only opened the envelope to 280 knots and 4.5 "G" but ultimately we expect to open to 350 knots indicated and 8 "G". Roll rate is extremely high and the maneuverability of the aircraft must be seen to be appreciated.

Since this aircraft is designed to be a close air support and anti-helicopter fighter, obviously, much of our test flying includes all kinds of aerobatics and tight maneuvering. Very exciting and lots of fun. The aircraft is equipped with an UPCO ejection seat which is a zero/zero seat. We will eventually install and test a 25 mm GE GAU-12, 6 barrel Gatling gun. This gun is capable of shooting 2000 rounds per minute and produces almost 11,000 lbs. of recoil!

The airplane flys somewhat like a large edition of Burt's VariViggen and, like the Viggen, it can be flown to full aft stick with no departure. All you get is an incredibly tight turn. Stall speed is 74 knots and we approach at 90 knots with a touchdown at 75-80 knots. It has very powerful dive brakes similar to the spoilflaps on the Solitaire. When these are deployed at 200 knots, the deceleration is impressive, throwing you forward in the straps.

We are still in the early stages of developmental flight testing and there is yet much work to be done. There has been a remarkable amount of interest in the aircraft so far and it promises to be one of Scaled's most interesting and successful programs.

Mike Melvill

LETTERS
"Dear RAF;

Please send me a copy of the flush rudder plans. I got a new pair of pants for Christmas that need a little epoxy dripped on them so they match the rest of my wardrobe.

Buzz Talbot"

"Dear Burt and Mike,

Enclosed please find a picture of N81465. First flight was Feb. 3, 1990, Hemet airport. My flying experience includes about 50 hours of Bonanza time, so I didn't have any reservations about being able to handle this beautiful machine. The part that I was most concerned with was making sure my powerplant and flutter tests would be OK. My first landing was a good one, but I used the whole runway as I had anticipated I would. I just didn't know how long it would take to settle in once in ground effect.

I started this project, s/n 571, in 1981 and worked on it off and on over the years and I'm really happy to say when asked, "Have you finished your airplane yet?", "Yep!" I enjoy looking at the expression on their faces as most people don't think you'll follow through with the project.

My first flight took place with only one other person around, George Kelley, my neighbor, who currently has 600 hours on his Long. To prepare for my first flight, I flew back seat with George and paid particular attention to how high the canard came up when he landed. That helped me to determine how much to flare when landing. I highly recommend that any first flight be done very early in the morning. This will give you a chance to experience your new bird in DEAD CALM WIND.....Airplane flew hands off, no turns, no rudder correction. (I must have done something right).

Many thanks to Burt for a GREAT design, Mike for his help over the years. I would like to especially thank George Kelley for his advice and help in getting me off the ground!!

Happy Flying,
Ray Gonzales"

CAUTION - OVERHEATED NAV LIGHT SWITCHES
"Dear RAF;

During a recent flight in our Long-EZ, N888EZ, there was A sudden, terrifying smell of smoke! Turned off all power and made it to an airport. A careful examination of the electrical system disclosed a rocker switch (standard Cessna part) had overheated and melted. This switch had push-on, spade connecters, and apparently over the years, one connection had oxidized enough between one spade lug and the push-on connector to create a high resistance. This, together with a 7 amp current draw (nav lights), heated the lug and internal parts of the switch enough to melt the housing, rocker and some other plastic internal parts.

This switch is used in all single engine Cessna airplanes and is a SPST radio switch, P/N S2160-1. This switch is both UL and CSA (Canadian equivalent) approved. It is worth noting that it is a CSA requirement (but not UL!) that electrical components using plastic materials can not burn. They can smoke, but must not burn. Builders should look for the stamp SA on their plastic electrical components.

What did I learn from this? Probably that screw-type lug switches are the right type to use even though spade connectors are more convenient. These Cessna-type switches are cheap at only $2.15 each even at Cessna's inflated prices, but it could have cost a lot more in hardware and even human life if it had failed only one hour earlier when I was on a night IFR flight from Las Vegas.

I will quit writing now because I need to get to the store to buy some better switches - - - - -

Dick Kreidel

SPORT FLIGHT EXHAUST SYSTEM FAILURE/SEPARATION AND FIRE ON GROUND - LONG-EZ, N80EZ

"I had just taken a passenger for a ride. The preflight and run-up were normal as was the full power run-up at take-off. At cruising altitude, I could hear an occasional unusual ticking sound in the headphones, but at the time it seemed like one the those sounds you get on a dark night or when over water (not in my Long-EZ, of course).

Return and landing were normal, as was the taxi in. However, being the ever vigilant, I decided to make a post flight run-up on the ramp. My friend, who is a very highly experienced pilot, was watching. As I was making the run-up, the RPM began decaying and the engine quit! At the same time, my friend called out 'fire!' I immediately shut off the mixture and fuel valve and hastily egressed while lowering the nose.

Unfortunately, I had left my Halon extinguisher in the hangar which was about 200 feet sway. I ran, retrieved my Halon - the hangar-mate next door brought his and we used both on the fire.

I don't know how long it takes to run 400 feet, but in that period of time the fire had a very good start. Both Halons were discharged and the fire was controlled.

I know there was not an in-flight, or taxi-in fire as my friend was watching. There was probably a crack in the exhaust system which was the sound heard in my headset.

The post flight run-up probably caused the final separation of the exhaust system and, of course,

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the fire. If I had suspected an exhaust leak, I would not have made the run-up. However, I'm glad it failed on the ground at run-up rather than in the air.

This, of course, is a very serious situation because of the total separation of the right exhaust system and the ensuing fire caused by the direct torching effect of the exhaust emission.

The torching effect probably would not cause a fire while flying because of the airflow, however, the metal parts separating from the aircraft is a sure problem.

This aircraft has a Lycoming 0-320B engine with a Sport Flight exhaust system circa '84. Total time on system, 225 hours.

The engine compartment was uncowled and checked 10 hours previously, with no apparent cracks or breaks.

The break was on the right rear exhaust at a point where the small 'S' tubing is welded to the larger straight exhaust pipe. The break was not in the weld. The break was right outside the weld on the larger pipe. It appears to be fatigue rather than a bad weld. What's puzzling to me is the springs that held the front tubing into the slip joint flange had stretched and given way. So now we have a total separation of the right exhaust system.

I'm sending the exhaust system to RAF for analysis. To my knowledge, this is not a common problem with a Sport Flight system.

I know the gentleman who produced the original system and consider him to be conscientious and capable. However, all systems should be checked. In the meantime, I will endeavor, with help from you folks, to determine the cause.

The damage is repairable. It was confined to the cowling, rib heat shield, right exhaust and finish on the prop. All systems and components in the engine compartment will have to be checked.

I've seen some EZs operating without all the called for heat shields on the spar and ribs. Having these installed on mine helped, as did the fire sleeves on the fluid lines. One fire sleeve was damaged. If it had been unprotected, who knows?!

Some possibilities are:

1) Excess vibration causing the break, although none was detected.

2) The front springs letting go caused the total load to be carried by the welded area.

3) Exhaust system rubbing on the cowling during engine torquing. I did leave adequate clearance and also had someone run-up the engine while I checked the clearance.

4) Simply age fatigue of the system.

I'm sure RAF will have their suggestions to go along with my article. If anyone has had a similar problem, please contact RAF or me at the address below.

Hope to be back in the air soon. The EZ is a great aircraft.

Good luck, fly safely,

Bob Frazier

308 Bayshore Dr.
Cape Coral, FL 33904
813-945-4824

HOW TO PAINT ZOLATONE

One of the most misunderstood and misapplied techniques used on our EZ's is the multi-colored, textured paint called Zolatone. If properly applied, surfaces are good looking and incredibly durable - but if it isn't done properly the results will be disappointing. Luckily, it it not a difficult process to master and is actually VariEze.

First off, the glass surface needs to be sanded dull (approx. 50%) before you begin; use 50 or 60 grit sandpaper - it is not necessary for the surface to be completely dull. The next step is important; the surface must be primed! RAF originally stated the primer was not needed but believe me, the adhesion and chip resistance

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without the primer is not good. You will need a quart of Zolatone Plastic Primer #99 and some plastic primer thinner for spraying. The primer must be cut about 20% with the thinner before use. This primer is (unfortunately) white in color but can be tinted using lacquer or acrylic lacquer tints. Tinting the primer will help hide the white from showing though after the colorcoat chips or wears. The primer goes on best with a standard external mix spray gun with siphon feed - it sprays like most lacquers. It is not necessary or desirable to put on a heavy coat or even to completely hide the glass underneath. A light coat is best. The primer dries rapidly and you can spray the color coat in an hour or two. Do not spray the primer more than 8 hours before you apply the color coat or else you will have to scuff sand the primer - a big, big, job!

A few words now about what Zolatone actually is will help you understand why the following procedure is important. Zolatone paint is actually a colloid, or in plain language, globules of colored nitrocellulose (lacquer) enclosed in clear "sacks", suspended in a water base solution. Zolatone calls these sacks aggregates and manufactures aggregates in three sizes: fine, medium and heavy. They have about 20 colors of aggregates and by mixing different colors of aggregates and by mixing different colors and sizes of aggregates, the factory can create an almost unlimited array of colors. Most of their standard colors use 2 to 5 different color aggregates in different sizes and proportions. In addition to the aggregates, some colors also have black, white, or green "flecks" which are like super big aggregates. These flecks appear as large streaks on the sample chips, it is possible to spray the base color and avoid flecks (if desired) by a variation of the technique.

Since this paint is a collection of aggregates or colored sacks floating in the water carrier, it is extremely important not to break up the sacks when you open the can and start to stir. Never use a power mixer or paint shaker - you will break all the sacks and will be left with a gallon of slushy mess. Gently stir the paint with a wide stick as little as possible, and then finish the mixing by "boxing" the paint; that is, gently pouring the paint from one container to another

until the paint is uniform in consistency. Zolatone will not appear as you would expect to see (or like the finish surface) at this point - but keep the faith!

The biggest mistake that people make with Zolatone is using the wrong type of spray equipment. This stuff absolutely, positively must be sprayed using an internal mix, pressure feed system. Most people are unfamiliar with internal mix because these guns are generally the cheap ($20-30) ones. You can recognize this type by the slotted air cap instead of what you normally see at the business end of the gun. What makes these cheapies less than ideal for most Zolatone colors (the Lilithe Charcoal is an exception) is that when in the pressure mode, the fluid pressure and air pressure are equal. What you really would like to find is a "dual-regulated, internal mix, pressure" set-up. For those of you who want the ideal rig, it would be a Binks #2001 gun with #6633x200 nozzle assy.. internal mix air cap and a dual regulated one quart pressure cup. A remote tank with hoses to the same gun is even neater because the gun will spray in any position (in the strakes, upside down, etc.)

OK, you've borrowed, bought or otherwise found the correct spray gear, primed the cockpit and are ready to go. Zolatone is applied in a two step process:

Step 1: This is the background color(s) step and utilizes high air pressure and low fluid pressure. Try about 40-45 psi on the air and 15-20 psi on the paint (fluid). Keep the gun 6"-12" from the surface and apply enough to cover the primer. You can alter the air and fluid pressure and change the appearance of the pattern - what's important here is the pressure differential between air and fluid.

Step 2: This is the pattern step and uses low air and high fluid pressures. This is when the large flecks and wild patterns are applied. If you don't want the big flecks you can minimize the pressure differential and obtain varying results. Assuming you want it to look just like the color chip, try 15 psi on the air and 30-40 psi on the fluid. Make sure you are 18"-24" away from the surface and apply the patterns until you have what you want. During this step, the more paint you apply the more fleck you will end up with so you need to carefully watch to make sure all areas

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are uniformly patterned. With both steps you can play with the air and fluid pressures and the distance from the surface and obtain very different appearances. It's always a good idea to experiment some with this stuff on some dense surface material (aluminum, masonite, etc.) before you start in on your plane to be sure of your technique and preference. Also, you should write down somewhere what air and fluid pressures you used for each step so that years later when you want to touch up some areas it will match perfectly - otherwise it won't!

Clean-up is as bizarre as the paint is - use water first and then lacquer thinner. Another interesting point is that since these colors are actually composed of multiple colors and sizes of aggregates, you can mix Zolatone standard colors (by boxing) to come up with your own

special mix. Zolatone will make any color you want but insists on a 23 gallon minimum order - no exceptions! There are about 12-13 colors that are standard other than the 2 or 3 stocked by Aircraft Spruce. You can contact Zolatone (aka Paramount Paint and Lacquer) in L.A. for their local dealer in your area.

To review a few key points:

1. The unique look is achieved by the splattering of the sacks as they impact the surface. In the gun and just before they hit, they are still discrete globules.

2. You need an internal mix pressure feed spray gun for the color. Since Murphy is alive and well, this gun is not great for the primer.

3. Use care in gently mixing the paint by initially stirring and boxing.

4. Don't allow the paint to freeze (water base) or you'll have a big mess!

5. Many builders find that painting the interior is easiest if the fuselage is supported upside down on a couple of saw horses - you crawl underneath and just do it!

Dick Kreidel

COMPRESSION TESTING
There are two accepted methods of testing the compression in a cylinder of an internal combustion engine. One is the "direct" method, generally used by auto mechanics on auto engines. This method uses a pressure gauge which is connected directly to the spark plug hole and the engine is than turned over with the starter or the engine and is run at idle. The peak pressure is read directly from the gauge. This method works but the results are not as precise as the method know as "differential compression" testing. This method is what is normally used in aircraft engines and requires the use of a tester consisting of two separate pressure gauges, a pressure regulator, a calibrated restrictor orifice, and an on/off valve. (See schematic) A source of compressed air (a compressor with a storage tank capable of a minimum of 100 psi) is required to perform the test. When you buy your differential compression tester, be sure it has a restrictor orifice of .040" (assuming your engine has less that 1000 cubic inches of displacement. An 0-235 has 235 cubic inches, and 0-360 has 361 cubic inches). Your can find several suppliers of good reliable differential compression testers at Aircraft Spruce or Wicks, or even "Trade-A-Plane".

SKETCH OMITTED

Continental, Lycoming and the FAA all agree that the compression test should be performed with the engine hot. This assures that you get optimum piston ring and valve seating. In any event, you should try always to use exactly the same procedure with each cylinder and each time you check your compression, if your testing is to give meaningful and comparable results. Careful and regular compression testing say, every 100 hours, can be one of the best, most cost effective preventive

maintenance procedures. It is very important that accurate records are kept of which compression reading was for which cylinder! You

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can read the number of each cylinder at the base of the cylinder. Note that Lycomings and Continentals use a different numbering system.

Remove the top spark plug from each cylinder and, for safety, remove each ignition lead from the bottom plugs. Rotate the prop by hand, in the normal direction of rotation (anti-clockwise for an American engine) until one of the cylinders comes up on compression. You can determine this by placing your thumb over the spark plug hole and feeling for a pressure buildup. Now, install the adapter (normally supplied with the compression tester) in the spark plug hole of the cylinder to be tested. Be certain that the air shutoff valve on the tester is off and connect the differential compression tester. CAUTION: Be absolutely certain the shutoff valve is closed and that you have a firm grip on the tip of one blade of the prop before connecting the system to your source of compressed air.

You will now have to find top dead center on the cylinder being tested. The easiest way to do this is to adjust the pressure regulator to about 20 psi and open the air shutoff valve. Carefully rotate the prop in the normal direction of rotation against the 20 psi pressure until you feel a "flat spot" or rapid loss of turning resistance. If you go too fast, back up beyond top dead center and try again. It is critical that you reach TDC with the prop turning in the normal direction of rotation, not while backing the prop up since this would unseat the piston rings. The piston rings must be at the bottom of their lands in the piston with the piston at the top of its travel.

Now, be certain you have the prop tip securely held. This is a good time to have a second person to help you. The air shutoff valve should be open and the pressure regulator adjusted to show exactly 80 psi on the pressure regulator gauge. Use caution because if you let the prop move in either direction beyond TDC, it will rapidly begin to rotate and it could beat the tar out of the unfortunate person who should have been holding it securely! Now, gently move the prop tip back and forth, just a tiny amount. Watch the cylinder pressure gauge and take a reading from it at its peak steady pressure. Again, this will be while moving the prop in the normal direction of rotation. Be certain that the regulator pressure gauge is holding precisely 80 psi. You should have a differential pressure reading of between 60 and 78 over 80. Repeat this test as consistently as possible on all cylinders.

You should now have a series of numbers something like this, depending on the condition of the engine: 76/80, 74/80, 73/80 and 75/80. These numbers, hopefully, will be fairly close to each other in magnitude. What are the limits? What constitutes a bad (too low) cylinder? It is generally accepted that a cylinder reading below 60/80 would require removal from service. There is no rule or law that says this is the case. In fact, the FAA as well as the two engine manufacturers have no such requirement.

You should probably continue to operate the engine and check the compression every 20 hours or so if the compression is 50/80 or above. Before you remove any cylinder, it would be a good idea to borescope the cylinder. That is, to look inside through a spark plug hole using a light and a special optical device known as a borescope.

A single compression test does not necessarily mean anything. A single oil analysis also means very little. No single diagnostic test should ever be used to decide the health of your engine. The key is to do these tests regularly and keep good records of what you see. Compare each test and make your decision based on several tests conducted over a reasonable period of time.

If you have an abnormally low cylinder, you should start the engine and run it on the ground or even fly around the pattern once. Test it again. If it is still low, use a length of garden hose as a "stethoscope" and listen at the exhaust of the ailing cylinder. If you hear a hissing escape of compressed air here, you have an exhaust valve that is not seating. Similarly, listen carefully with the "stethoscope" at the carb or intake airbox. A hissing sound here would indicate leakage under the intake valve. If neither of these areas is leaking significantly, listen at the breather or oil dipstick/filler tube. A leak in this area is indicative of ring blow-by. This could be ring wear, barrel wear or scoring, or all the ring gaps may be lined up. Hissing between cylinder cooling fins is bad news, possibly a cracked cylinder. Valve leakage is the most commonly found cause of a low cylinder.

The differential compression test has its limitations but it still remains one of the best, most cost effective preventive maintenance procedures available to the builder/flyer. The method described here is simple and it works. Done every 100 hours regularly, you could save big bucks in the long run.

If you would like to learn more about this procedure and many other cost saving tips for keeping your engine in good shape, you could not do better than to obtain a copy of "Top End" from the Light Plane Maintenance Library.
Write to: Light Plane Maintenance
1111 East Putnam Ave.
Riverside, CT 06878

FOR SALE
Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set
Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 9350
805-824-2645 (Tues. only)

Canard Pusher Digest - Stet Elliott's Canard Pusher Digest for the Long-EZ is still available. The Canard Pusher Digest is basically a recompilation of information from CP24-CP61 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, See CP57). Not that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

CP Digest for the Long-EZ. $67.00
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel.
Annual Update subscription. $25.00
(4 updates)
Overseas orders add $5.00 for
postage.
Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

One Directional Gyro, 3-1/8"
One Attitude Gyro, 3-1/8"
One Vacuum Gage
One Vacuum Regulator

Sell as one package - $325.00
Contact: Dan Mislik
421 Rolston Rd
Linden, MI 48451
313-735-9663

One Aluminum EZ Spinner - as new - $50.00

Contact: Dan Worley
818-366-8803

Computer program to calculate Center of Gravity on a Long-EZ or VariEze. Will work on any IBM or IBM-compatible computer. A simple program, EZ to use and it gives you a printout of your weight and balance to keep in your aircraft. A really simple and neat idea. Send $5.00 to cover the cost of the 5" floppy disc and postage.

James H. Langley
245 E Kimberly Street
Republic, MO 65738
417-732-1143

Bob Davenport nose wheel shimmy damper. Don't forget that Bob has informed us of his intention to quit producing this item. It is absolutely the best shimmy damper available at any price. Don't be left out in the cold, contact:

Bob Davenport
PO Box 650581
Vero Beach, FL
32965
407-567-1844

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
3850 Sherrod Rd.
Mariposa, CA 95338
209-742-6743

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

Unfortunately, we have to report that Great American Props has gone out of business. There does not appear to be much hope that they will recover at this time. We will, of course, keep you informed in this publication.

Bruce Tifft of B&T Props is, of course, inundated with orders at this time. He is doing his best to get the orders out as soon as he can but he has requested that we let you know that as of April 1990, his delivery time is a minimum of 3 months after receipt of order. He has requested that if you need a prop, get your order in early. If you are about ready to fly and you have not ordered your prop, you are already in trouble!

Bruce has also asked us to pass on to you that if you already have received your prop and, particularly if it is a multi-laminate prop, you should store it by bolting it onto the prop extension. This will help prevent the wood in the hub from swelling in a high humidity area. If this happens, the prop may not fit onto the drive lugs due to the counterbored holes having closed up a little.

Bruce is very much into the wood prop manufacturing business and is constantly testing new ideas on his own Long-EZ. He is very knowledgeable on EZ props and is more than happy to advise you on which prop you might need for your VariEze, Long-EZ or Defiant.

As far as we know, Ted Hendrickson is still in the business of manufacturing wood props. Ted has been in the prop business for many years and he is well known for building really marvelous examples of special one-off, three and four blade props of wood for old biplanes. We saw a stunning example, mounted on a Kinner engine, in a Fleet biplane on Long Island, NY. Of course, he also makes the more conventional two-blade, EZ-type propellers

With Great American Props gone, there is going to be some tough times ahead. GAP probably had the lion's share of the homebuilt market, shipping about 50 props a month. RAF has always advocated having two props. Let's face it, it is not unusual to damage a wood prop, particularly on a pusher like an EZ. If you have a spare, you can keep flying while you repair/refinish your spare prop. If you only have one, you may be grounded for quite awhile.

Whoever you decide to order your prop from, get your order in early! Don't wait until the last minute - you may be very disappointed.

PLEASE NOTE NEW FORMAT

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

VARIVIGGEN MAN/GND
VARIEZE MAN/GND
LONG-EZ MAN/GND
DEFIANT MAN/GND

The cause of the VariEze accident that was reported in CP 62 that occurred at Aspen,

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Colorado has been determined by the FAA to have probably been fuel starvation resulting in engine stoppage. Since this EZ was definitely fueled while parked in the nose down position, the FAA has asked RAF to remind our VariEze, as well as Long-EZ, builders/flyers that if you are planning a long cross country and expect to have full fuel tanks, it is mandatory that you fuel the aircraft while it is sitting level on all three wheels. This is the only way you can actually fill the fuel tanks to their maximum capacity. Obviously, if parked nose down (nose wheel retracted), you will not be able to completely fill the fuel tanks and depending on where you installed your fuel caps, you may, in

fact, be several gallons short. We would also recommend that you fill the tanks yourself rather than have the line boy do it. Depending on how large the vent holes are in your fuel tank baffles, to someone not familiar with your airplane, your tanks may appear to be full when, in fact, they are not. Above all, remember you, the pilot, are responsible to see to it that you have sufficient fuel for the proposed trip.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

CAUTION
When using the breather system that Mike recommended in CP 56.

Several builders/flyers have informed us of a noticeable drop in fuel pressure, especially at low power. Mike had also noticed this and attributes it to the reduced pressure inside the crankcase acting internally on the diaphragm in the engine driven pump. Mike has been flying this system for 640 hours now with no problems, however, you should be aware that it may be possible to reduce your fuel pressure almost to zero at low power, particularly if you have a new, tightly sealed engine. Contact Wes Gardner for more information.

CAUTION - WHEEL BRAKE DISCS RUNOUT.

This can cause vibration in your main gear as you apply the brakes. Use a micrometer to measure disc thickness. Check it in six or eight places around the disc. Thickness should not vary more than .002". Use a dial indicator to check for side-to-side out-of-true. We have seen Cleveland brake discs run out more than .020"! This is completely unacceptable. Sometimes is it in the disc weldment itself, but even more upsetting, it can be in the machining of the wheel halves themselves! If you suspect this, you should return them to Cleveland for replacement.

A better bet may be the new Rosenhaan brakes. While we have not actually tried them, we recently saw a set and they are really neat. They have a very heavy (thick) disc and have dual calipers with four brake linings. Should have serious stopping power. The neat part is they are VariEze to true up if ever they should start to chatter. Simply have them ground flat on a Blanchard grinder. The disc itself is a flat piece of steel. If you are interested in this type of brake, contact: Phil Mattingly
PO Box 8604
Salt Lake City, UT 84108
801-583-2118

CONTINENTAL ENGINE OWNERS
We have heard from several Continental engine owners of a problem they ran into when rebuilding their engines. It has to do with the camshaft. Specifically, the gear on the end of the camshaft that normally drives a vacuum pump or a fuel injection pump. Since most EZ drivers don't have vacuum pumps or fuel injection pumps there is a

tendency to remove this little gear and install the camshaft without the gear. This is fine, but if you decide to do this, be aware that it is critically important that you install the 6 small screws that would have held the gear in place and safety wire them together. If you omit this step, you will find to your frustration, that when you start your newly rebuilt engine that you have ZERO oil pressure! This is because the six drilled and tapped holes in the end of the camshaft intrude into the main oil galley in the end of the shaft and it is a requirement that all 6 screws are in place to retain the high pressure

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oil. You don't need the gear, but you absolutely do need the screws.

YET ANOTHER LORAN UPDATE!
Just when we thought we had reported all we know! We now hear from a builder/flyer who tried Mike's loran antenna as described in CP 62. He built it exactly as shown and his Northstar performed poorly. Low signal-to-noise ratios. He tried all the usual things, alternator filter capacitor, voltage regulator, etc. Finally, a friend suggested that since he had his main electrical power wires running down one side of his fuselage, and his ground wire running down the other, that maybe this was causing a field (like an electric motor) with his loran antenna base right in the center of the field!! (We could not believe it either!). Anyway, he finally bit the bullet and ran a new ground wire on the same side as his power wire. The optimum wiring scenario is to wrap the power wire around the ground wire at a spacing of two twists per foot of ground wire. This, in effect, eliminates the field caused by running the two wires parallel to each other. PRESTO - his SNR's were as they should be, high 80's and 90's percent for the Southern California area. Weird, but if you have tried everything else this is something to consider.

On the same subject, Mike's Northstar loran suddenly developed a case of low SNR's. Maybe he was forgetting, or ignoring, the fact that he had recently had to replace an alternator. (He had had the old one since 1980 and it was used when he got it!) His alternator is an Airborne aircraft-type, 28v, 60 amp. The rebuilt one, looking exactly like a new one and costing big bucks, was bolted on and it worked fine. At least, it was charging.

Anyway, when the loran signal-to-noise ratios declined, he assumed it was the filter capacitor. Upon removal, it was found to have a broken connection. A new one was purchased from Dusty Rhodes at Vista Aviation on Whiteman Airport in Los Angeles. The cost is about $26.00 and without one of these in parallel with your "BAT" connection and "Ground" connection on your alternator, your loran will never work much better than at 30% of its capability.

This helped, but did not cure the problem. The next purchase was a B&C linear voltage regulator from Bill Bainbridge of B&C Specialties in Newton, Kansas. This replaced the cheap looking Cessna-type regulator Mike had since building his Long-EZ in December of 1980. Well, to make a long story even longer, this did not do the trick either! Finally, he did what he should have done in the first place, he turned off the alternator field while in flight, while actually looking at the signal-

to-noise ratios displayed by the Northstar in the self test mode. As you will have already guessed, these percentages jumped from the low 30's to the high 90's!! A trip down to Vista Aviation and Dusty diagnosed bad diodes in the new alternator!

After all that work and all those dollars! At least, now everything in the charging system is new and the linear voltage regulator is a much superior design from a noise standpoint. Aviall replaced the faulty alternator and now the loran is back to its usual excellent performance and usefulness.

VFR-MOJAVE TO LONG ISLAND, NEW YORK IN A LONG-EZ
I have almost 1600 hours in our Long-Ez, N26MS, which is equipped for light IFR (or California IFR) including a full gyro panel, localizer, glide slope, Northstar loran, transponder and encoder, oxygen and a big engine. The airplane I was about to ferry across the USA was equipped with an 0-235-C2C, 108 horsepower engine, a one-and-a-half nav/comm (so called because you can comm or you can nav but you cannot do both), and a recently installed Micrologic ML6500 loran completed the avionics package. It was to be a real back-to-basics experience for me.

I went over the airplane very thoroughly prior to departing and felt good about its ability to make the trip. The weather in March across the nation is not always great, but I was hoping for good VFR.

I took off from Mojave just as the edge of the sun showed on the horizon. I had some baggage and full fuel tanks so with just me in the front seat, take off weight was at 1380 lbs. She used up only 1500 feet of runway to break ground and climbed

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well at 800 feet per minute. I climbed to 11,500 feet and set sail for Santa Fe, New Mexico, direct. This is a very rugged route, but is quite spectacular and beautiful. I passed by the San Francisco peaks at Flagstaff, Arizona in 2-1/4 hours. These mountains are very scenic, reaching to almost 13,000 feet and covered with snow. I flew over the Navajo and Hopi reservations to Santa Fe, all the way with beautiful clear blue skies and unlimited visibility - and a 10 knot tail wind!

The weather man had told me of a huge, fast moving, cold front coming down from Canada into the nation's midsection but I was hoping to beat it. Alas, no such luck! As I peeked over the Rockies at Santa Fe, there was a solid undercast as far as I could see. The bad news was it was all the way to the ground. Tucumcari, NM, was zero/zero in blowing snow, as were most of the other towns along my intended route of flight.

I changed my route to follow the edge of this cloud mass and found myself going almost south to Roswell, NM, then southeast to Midland, TX. From there I flew south of Dallas-Fort Worth and on over to Pine Bluff, AR, where I landed and spent the night. This was a flight of 9 hours and I used 46 gallons of fuel for an average fuel burn of 5.1 GPH. There was a flight service station at Pine Bluff but it turned out they did not open on weekends! The outlook for the morning was pretty dismal but I got a good night's rest at the local Holiday Inn.

I departed Pine Bluff at dawn in a fine drizzle with visibility down to 3 or 4 miles. I headed southeast toward Florida to get out from under the front which had overtaken me during the night. I crossed Mississippi, Alabama and Georgia in light rain, poor visibility and low ceilings. Quite a change from typical Southern California weather! I crossed South Carolina and North Carolina into Virginia. I crossed the coast at Norfolk, VA, 15 hours and 41 minutes after departing Mojave. I had failed to beat the front to the coast however, and although I tried to fly up the east coast along the beach, I only made it as far as Accomack County Airport on the Delmarva peninsular (Delaware, Maryland and Virginia). It was raining very hard as I flew up the coast and I actually picked up a pretty good load of ice trying to make it to Salisbury, before turning back to land at Accomack Co. I spent the night in a delightful motel called The Captains Quarters - good food and real friendly people.

In the morning it was snowing! Ceilings were quite low but visibility was acceptable so I flew up the beach across the mouth of the Delaware, past Atlantic City where the ground was white with snow all the way to the beach! The weather improved dramatically as I flew north and was clear as I worked my way around the New York TCA. I crossed the Long Island Sound and landed at Mattituck airport, my destination. A short airport with an approach over some 30 foot trees. A very tough proposition in a Long-EZ. I was thankful to get it down in one piece.

My trip had covered some 3000 statute miles in 18-1/2 hours using 99 gallons of gas for an average fuel burn of 5.3 GPH and an average ground speed of 162 MPH. Not bad economy - over 30 miles per gallon.

The 1-1/2 nav/comm was a pain in the neck and I really missed my KX-155 with flip-flop frequencies. The Micrologic loran was amazingly accurate and performed very well but it, too, is a high workload since it has no database and every waypoint must be entered as you go. This was tough at times, especially when the weather was bad, which it was for more than half the trip. I must say, I did enjoy the trip overall. It is quite remarkable that a simple, built-exactly-to-the-plans Long-EZ can be such an efficient, comfortable flying machine.

Sally and I will be essentially repeating this trip in June in our own Long-EZ. It will be interesting to compare the two airplanes.

Mike Melvill

ACROSS AUSTRALIA, NONSTOP - TWICE!
The trip from Brisbane to Perth nonstop and return three days later, is a crossing of 1948 nm Great Circle Route across Australia. This was a planned, nonstop trip to see our buddy homebuilders in Western Australia for the weekend function. The trip didn't take long but the drama of preparing paper work to satisfy the bureaucrats was something else. To get a permit for a homebuilt 39% overweight, for a 16 hour

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flight sounded easy. The reply was, "We have never done this before." Nothing is impossible; the Civil Aviation Authority chaps are great

guys but are bound by structured rules that are out of date. With a so-called modern aircraft, Long-EZ or, for that matter, anything different - with no engineering justifications; the EZ Flight Manual so conservatively written - things looked bad for any approval.

The only way to get anything through is to sit back and wait until you US EZ guys do your thing and get approval on History of Performance, but this is where it starts for us down under.

I must thank Rutan Builder Support for all their time and nonprofit effort to justify overweight Long-EZs that have flown in record breaking attempts with success. After this effort, all this evidence had to be set up properly by an aeronautical engineer and his Statement of Approval was necessary. The tank and fuel system had to be designed; the tank, 9G forward load with 7-1/2 psi pressure test, weighed only 9 lbs. Fibreglass/foam panel is amazingly strong. The tank, 49 US gallons, was built in a big hurry. Some glass/foam panel was left over for an oil tank made with 5 minute flox joints.

Nothing was built until approval for safety and airworthiness came through the system. The Engineer had to have all the Special Flight Manual Inserts with CAA signatures all over them, and a one square meter drawing of tank and fuel system. It all looked good in the end for a late getaway. As usual. Jean, my son, Glen, and friend crawling all over the Long-EZ for the final inspection/completion.

In the rush, a last minute decision to try the Vortex Generators - this time without approval, fitted on the canard. On the way to the Brisbane Airport, 75nm, I found a cloud to try them in. Believe me, it really worked. No down pitch. I knew then that I might stand a chance for a successful trip.

Next morning, raining, of course. After the rush of preparing for this flight, the three hours sleep were welcome. There was no point in expecting a VFR departure 2 hours before light so I waited till first light and saw a couple of holes in the sky - really only good for F18-type aircraft. The rain had eased with low clouds, 1/8-1800 ft. Out came the TV cameras. Two national channels had been waiting in rain 2 hours but they weren't disappointed. The aircraft, at 1850 lbs. approved maximum take-off weight, flew normally and climbed 500 ft./min. under this cloud cover. Testing the canard and climbing into this spitting heavy cloud for 15 minutes. was fine, "the bloody thing worked, no trim change."

Departed on radial, clocked on departure by the Tower, and I disappeared into a white, precipitating cloud and never saw the ground for 30 mins.. while climbing a coastal range. The stick pressure did get heavier as it rained, but climbing with this weight, normally my canard would have given up long ago.

Now settled in at 10,000 feet in between stratiform layered clouds, I knew this was about as bad as it would get for this trip. Bearing west for 945 nm, intercepting a couple of NDB stations, went smoothly. The fuel burn was established on the Alcor Fuel Meter and full throttle was acceptable with maximum fuel flow of 22.5 liters/hour (5.9 gal.). The 0-235-L2C maintained 2700 rpm with all engine gauges showing normal and the TAS averaging 150 kts., over and back.

Very soon the tree line disappeared, leaving red sand and only an occasional salt lake for direction. At the 945 nm mark, the NDB was working. The average ground speed was now 145 kts. for the 945 nm. The next 757 nm was strictly dead reckoning, 5 hrs. on the new RMI compass, resulting in a track error of 3o or 40 nm off track, acceptable for a homebuilt, plastic aircraft.

The next, and last, 300 nm flight was over a civilised part of the country with a few trees visible and signs of cattle tracks leading to water holes and, soon after, the fields were ploughed.

The sun was still high in the sky giving a beautiful reflection in the Indian Ocean. This was one of the highlights of the trip - to experience seeing the Pacific Ocean on departure and then, the Indian Ocean on arrival. This puts it together in a nutshell: it's a long way across this 2000 nm wide, barren continent in a light aircraft, nonstop.

The reception was overwhelming with meeting old friends again. The TV didn't miss the landing

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either. So now the Long-EZ, "Winglettes" stands taller in the misnamed category "Ultralite".

The trip from Perth to Brisbane was much easier to handle and it helps if you go to sleep sometimes. The return flight from Perth started 2 hours before first light and I must say, in Australian terms, "as black as a sheep's gut". When dawn broke, I was 10,000 ft., in stratiform layer clouds with the outline of the coast to the south; a beautiful sunrise mixed with Swan Lake stereo music tickling my excitement made it one of my life's most precious starts for the day.

I flew over the South Australian coastline with 700 miles of the whitest and purest beaches fading from green to the deepest blue ocean you'd find anywhere. I have flown this area with Jean at water level; it's beautiful, pure, clean and undisturbed. This trip was a mixed bag of air with little, if any, tail wind. Density altitude for most of the trip over and back was around 12,500 ft. I used only .5 liters. of oxygen and I'm sure this kept me on the ball.

Long range flying is another dimension of flying, if you can lie back as you do in the Long-EZ, you don't get muscle fatigue from sitting, I was amazed. The fourteen hours soon went in excitement.

Eventually, the coast came up - Brisbane at 10,000 ft. for a Tower clock timing a final decent to Oakey, 75nm west again, landing in the night.

What a private welcome! Jean had the hangar doors open and we had lots to talk about.

FILED RECORD

BN - PTH - 1948 nm (Great Circle) clocked 13 hrs., 41 mins.., (heading west) 145.57 kts. av., 24.12 L/hr (6.35 US gal.) - 380 litres fuel useable - 330 litres used - 50 liters remaining.

FILED RECORD

PTH - BN - 1948 nm (Great Circle clocked 13 hrs.., 55 mins.., (heading east) 140.88 kts. av., 24.43 L/hr. (6.45 US gal.) - 380 liters fuel useable - 340 litres used - 40 liters remaining.

FILED RECORD

Longest distance-2037 nm nonstop for C1B Class, Australia."
Magna Liset

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Magna Liset (Rt) & his navigator for the Around Australia Race, Wayne Johnson. (See CP29) VH-MJL is of course, Magna's Long-EZ which he used to fly twice across the width of Australia.

Al Fink's beautiful VariEze just out of the paint shop. The helpers are Dan Pierson, Louie, Brian Blue, Billy & Al Fink. Al hopes to fly from Mojave airport some day real soon.

CP63, Page 15

Burt's latest - "Ares", a single engine jet fighter powered by a JT-15D Pratt & Whitney engine with 2900 lbs. of static thrust. Seen here on its second flight chased by Burt's "Triumph", a Williams powered twin engine, 4 to 6 place mini business jet. **PHOTO OMITTED**

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 64.
VariViggen (2nd Edition), newsletter 18 to 64.
VariEze (1st Edition), newsletters 10 thru 64.
VariEze (2nd Edition), newsletters 16 thru 64.
Long-EZ, newsletters 24 through 64.
Solitaire, newsletters 37 through 64
Defiant, newsletters 41 through 64.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 12:00 AND 1:00 to 5:00 When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. It is required before you can be put through to Mike. This is a company policy and we must adhere to it.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

OSHKOSH 1990

BURT"S FORUMS:

FRIDAY, JULY 27 - 8:30AM - TENT 2 - BUILDER SUPPORT.

FRIDAY, JULY 27 - 11:30AM - TENT 3 - REQUIREMENTS FOR AVIATION GROWTH.

SATURDAY, JULY 28 - AA:30 AM - TENT 3 - THE COCKPIT - A DISASTER ZONE.

SUNDAY, JULY 29 - 11:30AM -TENT 3 - ARES - THE DESIGN PHILSOPHY AND TEST RESULTS.

MONDAY, JULY 30 - 1:00PM - TENT 10 - LADIES FORUM - THE REVOLUTIONARY CHANGES IN AVIATION.

ARES AT OSHKOSH

Scaled's flight test director, Doug Shane (also Long-EZ builder/flyer) will fly ARES to Oshkosh on Thursday, July 26th. He expects to make one stop to rest his buns and pickup some Jet A. He expects to cover the 1650 NM in 4.7 hours or so depending on winds aloft.

Mike Melvill will fly the ARES each afternoon on Friday, Saturday and Sunday at the show. ARES is a single engine, single seat jet. Using a Pratt and Whitney JT15D turbofan engine, ARES will true out at 420 knots at 25000 feet and will indicate 350 knots on the deck. Add to this, its ability to turn at over 30 degrees per second and an extremely rapid roll rate, a maximum of 8 "G", and you have a really fun to fly personal fighter. It will be on static display at Oshkosh Thursday evening through Monday morning. Be sure to buttonhole Doug, Mike or Burt for details on this VariViggen look alike.

SOLITAIRE - SELF LAUNCH SAILPLANE

"Solitaire N691LP flew for the first time under its own power on June 21, 1990. I tried to fly a few days earlier but several attempted take-offs had to be aborted. The engine sagged from vapor lock.

This is after 6-1/2 years of building and engine mount development. It all became worth it, however, with the dazzling take-off and superior cruise performance (75-80 knots).

The engine retraction and extension time of 4 to 6 seconds from door opening to engine running, confirmed my most optimistic expectations.

During the flight, the engine was stowed and restarted three times The landing was made as a sailplane. In a subsequent flight, a normal landing was made with the engine up but not running. Interestingly, the glide sink rate was 200 ft/min (31:5 L/D) but in this landing, it was only 400 ft/min. (16:1 L/D). This is a better L/D than the glider I learned to fly a lot of years ago. The rate of climb indications were not good but my estimate is 450 ft./min. at 1000 to 2000 ft . MSL on an 87 degree F day.

Engine problems were due to auto gas vapor lock on a 90 degree F day. I changed the fuel to 100LL then changed the plugs to NGK-B10-HV and added a Mikuni pulse pump at the fuel tank. All this was done on the advice of Frank Beagle, an experienced KFM Ultralight flier. Now the engine starts on the first revolution.

The airplane is exciting to fly...very sensitive to every air ripple. Now that I am less hyper, I find it responsive, stable and easy, easy to fly.

Herb Abrams"

Note: Herb is too modest. His Solitaire is absolutely gorgeous! The engine installation is what we at RAF, and probably most Solitaire builders, have been waiting for. A number of years ago (could it really have been 6 years, Herb?), Herb called to describe his novel idea for an engine/prop installation. A stock Solitaire folds the engine forward into the fuselage with the direct drive prop on the

bottom. This severely limited the prop diameter and, thus,, thrust and performance. Herb designed an ingenious "flip-over" engine mount that uses the same KFM engine but with a reduction drive and much larger diameter prop. When the engine/prop is extended for powered flight, it looks much like the stock Solitaire but when he folds the engine away (which only takes 4 seconds!), the engine flips over and the engine goes into the fuselage placing the prop at the top of the engine compartment just under the flush doors. You have to see it to believe it. I thought Herb had flipped his lid when he first called with his idea, but having seen his video tape and photos, I for one can't wait to see the real thing. Congratulations, Herb, a truly outstanding engineering achievement.

ED.

FLY-IN

LATE FALL FLY-IN, DRIVE-IN, EZ GET-TOGETHER
NOVEMBER 23, 24, 25 AT MINDEN, NEBRASKA

Sure it will be cold, but at least it won't be 110 degrees in the shade. Just wear everything you own, like when you go skiing or hunting. Here is a chance to walk off some turkey and get in the Christmas spirit.

The Pioneer Village Museum is open everyday and most of it is indoors. Friday night there will be pizza available in the motel meeting room. Saturday night in the town square, there is a Christmas pageant and their lights are turned on for the first time. This is a popular event so make your reservations early. Thirty rooms are being held under the name of "Central States Association Fly-In". Call: Pioneer Village Motel
1-800-445-4447.

LONG-EZ'S - TRAVELLING MACHINES
During one 3 week period a month or so ago, we noticed the following: Two friends flew their Long-EZ's from the LA basin to the southern Bahamas islands. Another friend flew to and from Kansas City for a weekend visit. A week later, Mike and Sally flew to New York and back.

These were only the people we knew of personally. There were probably others! Talk about a travelling machine - the Long-EZ, designed by Burt in 1979, was named for its long range and long endurance. It has really lived up to its name and its design goals

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FIRST FLIGHT
Andre Deberdt reports his first flight in his Long-EZ, registration number PP-ZAD. Andre is from Sao Paulo, Brazil. He worked on his airplane for 5 years before finally taking to the air. Unfortunately, his first landing was not as successful as his first flight. He landed hard, hitting the nosewheel hard enough to fail the 4 AN-525 washer-head screws that secure the NG-15A casting to the strut. All four screws pulled their heads off allowing the nose wheel/fork assembly to depart the nose strut. Andre maintained control and held the nose off as long as he could. Once he touched the strut (NG-1) down on the

runway, it ground off about 2". He slid for between 900 and 1000 feet on the end of the NG-1 strut.

Note: These four screws were changed to AN-3 bolts several years ago in the CP.

The mains hit hard enough to spread the gear to the point of grinding off one brake bleeder fitting, so he was without brakes. To his credit though, this was the only damage and he was out flying again the very next day, thanks to the generosity of a fellow builder,not as far along, who lent him a complete nose gear strut.

Andre tells us that his is the fourth example of a RAF design to fly in Brazil. There are now one VariEze, and 3 Long-EZ's flying there. He says he hopes to make it to Oshkosh some day and tells us that he is more satisfied with his EZ every time he flies it. Congratulations, Andre!

CAUTION
How do you know what you are getting when you buy a complete, or even a partially complete, composite aircraft?

RAF gets this question more often than we care to relate. It's a tough question and we honestly don't know the answer. Perhaps the most logical approach would be to look at one with plenty of hours on it. At least, the structure is proven. The other thing to look at is the structural weight. Beware of an unusually lightweight EZ (might have some lay-ups missing, also, watch out for an excessively heavy airplane. It will probably fail at a lower "G" than a normal weight EZ).

We recently heard of a nasty accident in a VariEze that really drives home the point we are trying to make here.

The buyer purchased a structurally complete VariEze. Most of the contouring was done but not the engine installation or the wiring/instrumentation. This person spent a couple of years of hard work and lots of dollars until he was finally ready to try out his new bird. On the first high speed taxi run, with the nose wheel off the ground, he started to get it light on the main tires when suddenly the left wing folded. The right wing was lifting quite strongly and, without the left wing to balance the lift, the airplane abruptly rolled over and left the runway. It slid to a stop inverted, and although the damage to the airplane was fairly minimal, the pilot was seriously injured and spent several months in the hospital recovering.

Close examination of the wing attach area disclosed the fact that the wing fitting attach screws had never been installed! Since the micro used to contour the wings was already installed, the buyer had no way of knowing. This is just one way you could get in trouble when you buy a composite homebuilt. RAF has always been a strong advocate for build-it-yourself. If you want an airplane, build it yourself. Follow the plans as closely as you can. Have your friends or fellow EAA chapter members look at it over your shoulder as often as possible. Be conscientious and accept only your very best workmanship.

There are currently somewhere between 1200 and 2000 Rutan designs flying. By far, the majority fly well and safely because their builders took care to build their creations as perfectly as they were capable of doing. By all means, build it yourself, but if you decide to buy one, keep this true story in mind, you cannot be too careful.

ACCIDENTS AND INCIDENTS

A Long-EZ based in Oregon crashed on take-off and the pilot was fatally injured. The cause is not known at this time but, as always, RAF publishes all accident reports we know of in the

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hope that these reports and analyses may help others to avoid the same problems.

The Oregon EZ had been flying for just over a year. It was reported to be a "work of art", a potential show winner. The pilot was in the habit of flying locally at least once or twice a week so he was very current. He was known for his steep climb-outs after take-off, so it was no surprise to the eye witnesses on the day of the accident when he climbed very steeply. However, at about 300 feet above the ground, the engine quit and the Long-EZ nosed over and crashed. There was no attempt to flare or land, it simply flew a parabolic arc and crashed nose first. The forward fuselage was heavily damaged but the wings, fuel tanks and centersection were essentially undamaged.

We may never know exactly what happened here, but the lesson that comes to mind is, as always, "Fly The Airplane". If you are still physically able to, you must maintain flying speed and you must contact the ground wings level, nose high at, or slightly above, minimum flying speed. Try to aim between any obstacles to minimize damage to the fuselage/cockpit area. You have an excellent chance of surviving any landing if the aircraft is under control when it touches down. Above all, never give up! Continue to fly the airplane right to the ground and then brake as required to guide the plane to a stop.

MOJAVE-WILKESBORO, NC-LONG ISLAND, NY-MOJAVE IN LONG-EZ N26MS
Sally and I had planned this vacation for months. We were ready and so was our Long-EZ.

We lifted off runway 7 at Mojave at 5:55AM and headed East. I climbed at 140 kts. indicated which, at our weight, yielded a 600 FPM climb. The Northstar showed a ground speed of 185 kts! Great tailwind even during the climb. We donned our oxygen cannulas (AEROX - simply the best - 11-1/2 hours duration with two people at 18000') and climbed to 17500 feet. Once we were level and trimmed out, we were looking at a true speed of 173 knots. while burning 6.4 GPH. The winds were pretty much on the tail giving us a ground speed that never fell below 200 knots for the first 1000 NM. At times, we saw 220 knot ground speeds on the loran.

Unlike the terrible weather I had experienced flying the 0-235 powered Long-EZ over approximately the same route (See CP63), we had glorious blue skies essentially all the way from Mojave to New York.

We stopped for gas in Rogers, Ark. then pressed on to Wilksboro, NC. Flying time was 9-1/2 hours. We used 63 gallons for an average fuel burn of 6.7 GPH. Not bad when you consider two climbs to 17500'! We averaged right at 30 NMPG (34 MPG) on the trip from Mojave to Wilksboro mostly due to strong tailwinds.

We had a marvelous 3-day weekend at a hot air balloon festival run by our old friend and VariEze builder/flyer, "Mule" Ferguson. We flew in hot air balloons, we chased hot air balloons all over the countryside and we had a ball. Thanks a million, Mule and beautiful wife, Debbie.

The trip from Wilksboro to East Hampton, Long Island, NY at 11500' took only 2.7 hours. Again, we got lucky and had a huge tailwind. We flew under the NY TCA at 500 feet, just off the beach. Quite an experience. You fly so close to Kennedy you can almost look into the windows of the airliners waiting to take off!

Although the route flown was not exactly the same, it was close. The 0-235 powered Long-EZ used 99 gallons and the trip took 18-1/2 hours. This time, our 0-360 powered Long-EZ used 83 gallons and the trip took 12.2 hours. The tailwinds had a lot to do with it, though - it took 16:10 to fly back to Mojave, bucking strong head winds and awful weather, at least to Ohio. Average fuel burn on the trip home was 8.8 GPH - the price you pay for the big engine if you can't go up high enough.

We stayed with a friend on Long Island and he and his wife saw to it that we had a splendoriforous time. We flew to Boston, then to Newport, RI. (Saw a completed Rutan Solitaire on the Newport airport.) We flew into New York City, flying down the Hudson river at, or below, 600 feet to stay below the TCA. We flew by the Statue of Liberty and landed at Linden, NJ. We spent 3 days in New York City and loved every minute of it.

We departed from Linden on a cloudy, low ceiling day and "scud ran" in driving rain for almost 4 hours! We landed for fuel in Burlington, IA and discovered that our voltage regulator had died. Sally called Bill Bainbridge of B&C Specialty in Newton, KS and he invited us to drop in. He also offered to trouble-shoot the problem, fix it or replace the B&C linear voltage regulator. He was as good as his word and, when he could not find the problem, he replaced the regulator. As we lifted the broken one out of the nose, it was dripping water! Bill took the lid off and, low and behold, it was full of water! Stupidly, I had installed it directly under the access door in the nose and my door does not have a good seal. Flying for hours in pouring rain had somehow caused water to get into the regulator and shorted it out! A valuable lesson - do not mount your voltage regulator where rain can get to it!

While I am on the subject of Bill Bainbridge and his B&C Specialty Company, I would like to thank Bill and his delightful wife, Celeste, for their hospitality and kindness. Bill really does have a neat little company in Newton. I got a tour of the facility and was

tremendously impressed. The lightweight starters, the linear voltage regulators, the various alternators, etc., all are built with incredible attention to detail. You have to see these accessories going together to appreciate just how much superior they are to anything else out there. By the way, you can order a brand new Lycoming 0-235, 0-320, or 0-360 from the factory equipped with one of Bill's beautiful starters! Bill really cares about us homebuilders and he strives to provide us with excellent parts designed to not only provide excellent service but also to give us the best possible performance and long life. The linear voltage regulator also provides absolute protection from an over-voltage spike thus keeping your expensive avionics safe. Before buying less expensive starters, alternators and voltage regulators, take a hard, critical look at what you get - believe me, I speak from experience!

We flew out of Newton during a summer thundershower and ended up fighting thunderstorms and rain all the way to Gallup, NM. From Gallup to Mojave the weather was perfect except for a 30 knot headwind.

N26MS now has 1630 hours on her. She first flew in 1980 which makes her almost 10 years old.

We have been all over the lower 48 states as well as Alaska and our Long-EZ has served us well. No question, our lives would not be the same without her. She has been ready to fly us anywhere, virtually anytime we wanted to go. Airframe maintenance has been essentially zero. Engine maintenance with the 0-235 was more than it should have been. We topped it twice in 907 hours. This was probably due to my running it too hard! The 0-360 has required no maintenance during the last 720 or so hours. We have had to have both magnetos worked on and we had an alternator failure once. We are extremely satisfied with our Long-EZ and would not trade it for anything.

Mike and Sally Melvill

WARNING- MODERN PAINTS CAN KILL

Scott Finnigan, a real up-and-coming aerobatic contender in a Pitts S-1-S died suddenly last December. There is a lesson that can be learned from this tragedy and you should be aware of what it is.

Last year, Scott painted some airplane parts in a small, unvented paint booth without using protective breathing equipment. Scott was spraying Imron. This material can be quite lethal and some of it got into his lungs. The damage was great and, sadly, incurable.

Be sure to use protective equipment whenever it is required by the manufacturer. Follow all safety guidelines - many of the modern painting materials are dangerous if not used in accordance with the manufacturers instructions. Modern polyurethane paint is just not like the old butyrate dope and enamels so many of us used to use.

SHOPPING

Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on

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your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set
Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 9350
805-824-2645 (Tues. only)

Canard Pusher Digest - Stet Elliott's Canard Pusher Digest for the Long-EZ is still available. The Canard Pusher Digest is basically a recompilation of information from CP24-CP61 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, See CP57). Not that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

CP Digest for the Long-EZ. $67.00
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel.
Annual Update subscription. $25.00
(4 updates)

Overseas orders add $5.00 for postage
Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS
RAF recommends the following prop manufacturers:
Bruce Tifft
B&T Props
375872 Mosby Creek Rd.

Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

FOR SALE

Regretfully, I must cannibalize my beautiful Long-EZ, N870FS. 160 hours on the airframe, 200 hours on the 0-235 Lycoming. Everything Goes - Call: Frank Swanson
38730 Brookside
Cherry Valley, CA 92223
714-845-5851

Lycoming 0-235-L2A, 1100 TTSN. Complete with accessories $3500.00

Continental 0-200, 200 Hours since Major overhaul - $3200.00

Two VariEze props and other misc. VariEze and Long-EZ components. Call or write for list
Don Bates
2742 Swansboro Road
Placerville, CA 95667
916-622-1886

Lots of used parts salvaged from a damaged VariEze. Write for list. Engine gauges, main gear strut, etc., etc. Also, an aluminum trailer - good for a VariEze or Long-EZ - Large wheels - $275.00
Bill Ingram
3328 Macauley Street
San Diego, CA 92106

The nifty sight gauges sold by John Van Ostrom are no longer available from him. I will be taking over from him and they will be the same unbreakable quality as before. Price remains the same at $30.00 per pair. ($36.00 overseas) I have had a pair in my Cozy for 2-1/2 years and visibility is super. I have been unable to break or fracture the clear plastic with a hammer (test unit!). Builders can contact me:
Vance Atkinson
3604 Willomet Ct.
Bedford, TX 76021

Northstar M1 Loran - with current update - works perfectly. Upgrading to King - $1750.00 (including tray), Bent whip antenna and antenna preamp. Contact: Mike or Sally Melvill
805-824-4541 days
805-821-1805 evenings

PLEASE NOTE NEW FORMAT

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

VARIVIGGEN -------- NO PLANS CHANGES
VARIEZE ----------- THIS TIME.
LONG-EZ ----------
DEFIANT ----------
SOLITAIRE---------

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

LETTERS

ATTENTION: ANYONE WHO EVER WANTED TO CROSS THE ATLANTIC . . .
"Planning my North Atlantic crossing began in May, 1989 when my wife, an Air Force physician, received word that her next assignment was to Hahn Air Base in central West Germany. I borrowed an old copy of IFR magazine (Jan. 1989) which had an article about such crossings written by an experienced ferry pilot. First, I contacted Canada Air Transport (Bob Lavers at 506-857-7131) in Moncton, New Brunswick, Canada. They sent a complete packet detailing the requirements for single engine North Atlantic crossings.

In short, they require a full gyro panel, two long range navigation radios, and a high frequency communications radio. I found a marine hand-held radio direction-finder that worked very well. The other long range nav radio I had was a loran. Loran coverage is normally good all the way to Scotland using the Goose Bay-Narsarsuaq-Keflavik route but the Labrador Bay chain was down for maintenance during my trip. I found out after buying it that my Northstar loran is not able to receive the loran chains in Europe or the North Atlantic past the Labrador Bay chain so I had to rely on my other nav radios. I was able to get a heading for the Simiutaq (SI) NDB on the coast of Greenland using both my Northstar and King Marine lorans before the Labrador Bay chain went down. I was able to use the East Canada chain all the way to the coast of Greenland, but the Northstar kept asking to change chains and warning about repeatability. The King loran worked great in the states but not at all in Europe.

For the crossing, a full immersion suit, life raft, and sea survival pack are also required. The spares that I carried were a set of plugs and oil. I used 100 weight oil but would recommend a lighter weight as it felt pretty stiff trying to hand-start in Greenland. Also, the oil temp never got over 120o between Greenland and Iceland.

Navaid Devices sold me an auto pilot and it worked well and let me relax a bit during the long legs over water.

Since the Long-EZ is classified as experimental, technically, we must contact any country in which we want to operate and request validation of our airworthiness certificates. Canada and Iceland were aware of

this rule, written in small print on the back of our certificates. Others were not. Eventually, all countries responded; Denmark said that they wouldn't validate my

certificate since my aircraft was not "certified", and I was in and out of Greenland before I even got their reply (which ultimately was "no"). The people at the airport in Narsarsuaq didn't care about this rule. They even let me park overnight in the hangar with the Ice Patrol planes.

For maps, I relied on Jeppesen. They sold me a North Atlantic set of charts, A VFR radio navigation chart for Germany, and an expensive set of books called a Bottlang Airfield Manual. The Bottlang books were very handy, with all the required details I needed for international travel.

I didn't install any extra tanks since I planned legs of only about 700 or 750 nautical miles. This left plenty of fuel to meet the three hour reserve fuel requirements of Canada Air Transport.

The trip itself started from Dunnellon, FL. I headed up the east coast to Barnes Airport in MA. On subsequent days, it was on to Caribou, ME and then across to Moncton, New Brunswick for the required inspection. Don't try to skip the inspection; security checked paperwork in Goose Bay and the officials in Iceland also checked the "ship's papers". After a low pass which the Moncton tower requested, I was off to Goose Bay about four hours north. Telephone ahead for a prior permission number that you will need for the approach controller (Goose Bay Operation at 709-896-7331). Outside the U.S., our airplanes get lots of attention, most controllers asked lots of questions if they had the time and always gave very good service. Goose Bay was my first landing at a primarily military airport, so phrases like "check gear down" and "arresting cable up" made the approach a little out of the ordinary.

Before I left, people I talked to about the trip said that the weather briefing that you get at Goose Bay is really something special and they were right. After having made an appointment the night before, the weather service had a folder ready for me covering the flight and a weather man met with me to go over it. I was following a high pressure system out to the U.S. and the weather couldn't have been much better.

After I was out of VHF range, I started using airline traffic passing overhead to relay my position reports. Over the North Atlantic, air traffic is required to monitor 121.5 and it is normal practice to call and ask for help with a position relay. My calls always got an instant response and we arranged to meet on 131.8, the air-to-air frequency assigned to the North Atlantic. Again, there were always lots of questions about my aircraft and the trip.

About seven hours out of Goose Bay, the coast of Greenland and the fjords that lead to Nararsuaq airport come into sight. Simiutaq NDB is on the coast and there are three choices for someone flying too low to pick up Narsarsuaq NDB. If you fly up the right-hand fjord, as I did,

you are on a long right base for the runway. For the center fjord, you jump over a hill and are on final. The third fjord does not lead to the runway. You shouldn't fly up the fjords if the clouds are below the tops of the ridges at 3600 feet but should use the Narsarsuaq NDB/DME approach. The charts show an instrument approach using the NDB and DME but the controller said that the airport is normally only open for VFR. I stayed at the Artic Hotel in Narsarsuaq; the only choice except in mid-summer. The room was warm and clean and reasonably priced at about $60.00 per night.

Overnight, Greenland had snow so I had to wait until noon before the low clouds and fog went out to sea. Just before I left, the weekly airliner arrived and said that they had a lot of turbulence over the ice cap on their way in from Iceland. So, I had to skip flying over part of the ice cap and head out to sea and around the southern tip of Greenland before heading for Iceland. Again, I got excellent weather service with hourly satellite pictures. The personal service might have been because the airliner and I were the only traffic for the day. My only alternate was

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Kulusuk, about 400 miles north on the east coast. Kulusuk was reporting a snow storm but I went ahead because the satellite pictures showed a clear path to Iceland.

The trip to Iceland was uneventful although very cold. I wore the immersion suit, pulling off the top half after climbing in. Wool pants and a down coat under the immersion suit were not quite enough. I was afraid to run the electric cabin heat since I could not tell if the legs of the suit were touching the heating elements. I was very cold by the time I reached Iceland, especially since it was in the 90's when I left Florida.

Iceland is supposed to be a North Atlantic radar outpost but they didn't see me until I was over land despite operating my transponder and giving them my flight level and inbound VOR radial.

If you can afford $150 a night for a hotel, the Lofleder Hotel at the Reykjavik airport is an excellent choice. It offers pilots a discount, has a heated pool and seafood lunch buffet that you shouldn't miss. I could only allow myself one night of luxury and then had to catch a shuttle bus over to Keflavik and stay at the Navy base (military only). I spent three days in Iceland waiting out both a wind and rainstorm with steady 35 to 40 knot winds and some military maneuvers that restricted low level flight between Iceland and Scotland.

The wind was not as strong as forecasted on the trip between Iceland and Scotland and I purposely over-corrected for the forecasted wind in a southerly direction so that if I was off course, I wouldn't pass north of Scotland. All this put me about twenty miles south of Stornoway when Benbecula VOR came into range. A call to Scottish information and I was on my way down the coast to Glasgow. Communications and radio navigation were weak down at lower levels in northern Scotland but improved after I cleared the hills and entered the valley leading to Glasgow. Strong winds and rain delayed my

departure from Glasgow the next day until nearly noon again and after flying southeast into England, I began to run out of daylight and the weather, while reported as clear in Germany, was turning into a sold deck below me. So, it was time to change plans and land at Teeside airport on the central coast of England after only a couple hours of flying. The next day was sunny and very windy but I was off to Germany. I had radar service all the way across the north sea. VFR traffic is required to descend to one thousand feet around Amsterdam and, again, I caught up with the rain and a forecasted ceiling. I passed a small airport just inside the German border and I called Dusseldorf radar to let them know that I was heading back there to land because of the weather.

My wife, Peggy, drove the two hundred kilometers north to pick me up. I had to wait out a week of clear skies until the next weekend when she could take me back up for the short flight down to Koblenz. The airport there has a 3000 foot paved runway and overlooks the Moselle river. This is homebase for my airplane for the next four years.

All in all, I had a pretty smooth trip. The only problem was the loran chain being down for maintenance and this shouldn't be a problem for future flights. For the flight back, I'm planning to build a back-seat tank and take the Shannon-Gander route or go through the Azores.

Juan Rivera"

"Dear RAF,

I thought I would write to report an exhaust failure on our Defiant that could have been quite serious.

This involved the front engine with about 200 hours on it. The exhaust was a unit purchased from Wag Aero. It is a standard wide deck exhaust for a Grumman Tiger.

The failure occurred at two places on the unit. One spot was on the exhaust stud coming from the right rear cylinder. It was a total fatigue fracture about 1/2" below the weld to the flange.

The other failure spot was on a lower left juncture of the combined pipes as they went into the muffler.

I could not determine which crack was primary and which was secondary, but I suspect one of them caused the other. What was interesting was that the cylinder near the site of the failure had been pulled by a repair facility when an intake valve cracked.

I did not oversee the repair since it was on a standard engine and muffler combination. After a discussion with Aero Fabricators who repaired the muffler, I came to the following conclusions: When the cylinder was pulled, they probably did not loosen the entire muffler from all the other cylinders. When the cylinder was replaced, the muffler was sprung back into place in a stressed condition and was bolted into place. Aero Fabricators suggested that when the exhaust

system was reinstalled after repair that it be loosely bolted into place and then heated by running the engine until it was good and hot. In this hot state, the cylinder bolts and sleeve clamps are then tightened to appropriate torque.

This exhaust system was only about 200 hours old. Since this was a certified muffler on a standard engine, things point strongly to an error in installation procedures. This caution might be relevant to other exhaust systems that are somewhat rigid between multiple cylinders.

We are also going to be balancing both engines in the near future since both starter ring gears were not part of the engines when we bought them. What was really scary was that we had a fuel line failure on the same flight on the same engine, within only 1 hour of each other.

The fuel line failure by the way was one of those fancy expensive lifetime custom made all stainless steel lines that come from Aircraft Spruce. It appears that the failure was a combination of a poor weld on the stainless steel tube and vibration failure. I am considering replacing them with good old rubber Aeroquip rubber lines that you periodically throw away. At least I never saw a rubber line fatigue.

Did you ever notice that it is all that metal on our fiberglass airplanes that seems to brake all the time? I think I am ready for fiberglass engine mounts and ceramic engines.

John Steichen

"Dear RAF,

"LUCKY YOU FLY A LONG-EZ " - AGAIN!

This is to relate to you an incident that occurred last Saturday, May 21.

I was flying PP-ZAD enroute to a fly-in in the south of Brazil at 8500' under positive control area and enjoying, in advance, my participation in the fly-in and the amazing performance of the Navaid Devices autopilot.

I suddenly smelled burning oil and, looking back, I saw some smoke in the cockpit and two trails of oil coming out of the oil filler door. I immediately reduced power to minimum and began to look for a place to land.

The only airport close by was under rain and no safe approach could be attempted due to mountainous surroundings.

Loosing altitude slowly (what a splenderous glider is the Long!), it soon became apparent that the only safe place was a new open-to-traffic freeway with not much traffic on it. After some low passes to make clear my intentions (oil pressure was at this time around 40 PSI down from 80 PSI), I was able to make one of my best landings, not even touching the brakes and with only 20 PSI oil pressure even taxied one more mile to an adequate place clear of the traffic to park.

Some 5 quarts of oil poured from the cowling when I lowered the nose. Next day we put in new oil, ran the engine and we observed the oil coming out from the hose connecting the oil cooler to the engine. A new hose was put on, engine checked carefully and I departed form the freeway again to my home airport.

Now, this airplane is very special to me and no efforts nor expenses were spared in all phases of its construction and choice of parts which had to be always of the best quality, not bothering with prices. Even a brand new engine was ordered from Lycoming.

When it was time to choose the hoses, I decided to use the "stainless steel hose assemblies" as advertised on page 84 of Aircraft Spruce's catalog (very expensive) instead of the regular rubber material. These hoses were made to order for the sizes I supplied (copy of invoice enclosed).

I am sending the failed hose to Jim at Aircraft Spruce to have it inspected by the supplier and I also already substituted all other hoses, even those carrying fuel, with standard Aeroquip shielded hoses.

These hoses were not abused in any way and were installed by a certified mechanic of our air club.

I hope that this may help any other builder who may decide to use these hoses in their airplane.

Thanks again for a wonderful airplane that is making me more confident every day in its capabilities and anticipating my hours of safe, enjoyable flying (not quite my wife's opinion).

Next day I was on a national coverage TV network - try to imagine answering all those phone calls!

Andre J. Deberdt"

PLEASE NOTE CHANGE OF ADDRESS FOR B&T PROPS:

BRUCE AND BONNIE TIFFT
B & T PROPELLORS
75872 MOSBY CREEK ROAD
503-942-7068

Herb Abrams and his beautiful new Solitaire, N691LP, with its nifty engine retract system. **PHOTOS OMITTED**

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 65.
VariViggen (2nd Edition), newsletter 18 to 65.
VariEze (1st Edition), newsletters 10 thru 65.
VariEze (2nd Edition), newsletters 16 thru 65.
Long-EZ, newsletters 24 through 65.
Solitaire, newsletters 37 through 65.
Defiant, newsletters 41 through 65.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 12:00 AND 1:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem along with a number where you can be reached, collect, between 3:30 and 5:00. Mike will try to return your call the same day. However, we ask that calls be limited to emergency-type situations and other questions be mailed in. When writing to RAF, send along a stamped, self addressed envelope.

TOUGH SLEDDING AHEAD FOR RAF

In general, I have been very pleased with the business performance of RAF since we discontinued the sale of plans and the licensing of individuals to build aircraft based on RAF design information. RAF made these moves in mid-1985 partially because of severe conflicts with other aircraft development projects at Scaled Composites which were taking all of my time and because of the expanding threat of lawsuits which often occur after an accident, regardless of the cause of the accident.

In 1985, I decided to keep RAF's doors open in spite of the fact that we had lost our primary source of income. The remaining assets of RAF would be used to continue to provide technical and safety support to those licensed individuals still building and flying their RAF designs. In order to provide the best service to those customers who were licensed by RAF, we discontinued the policy of allowing transfer of license and, in effect, promised support only to our direct customers. Those who bought a project or completed aircraft from "Joe Smith" must

be supported by "Joe Smith". We would maintain, to the best of our ability, our support of Joe, as our licensee.

In 1985, we believed that we would be able to continue support for 2 to 3 years in this way and thus, not strand any builder who had recently begun his project. Little did we know that 5-1/2 years later RAF would still be alive and well, providing support, continuing newsletters, continuing our talks and booth at Oshkosh, even helping new starts for those licensed in the early 80's and only now laying up the front seat fuselage bulkhead! Our survival has had a lot to do with a few key items:

1. Great support from our family of builders who helped police the cheaters (those who sought RAF support even though working without a RAF license). Understanding from builders when we raised our newsletter price from $7 to $14 and cut down on our hours of direct builder support. Support from those who still stop by our Oshkosh booth and load up on goodies.

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2. Patience, dedication and sacrifice from people like Mike and Sally Melvill and Joan Richey who hung in there even though it was obvious that the ship was beginning to sink. Their continuing dedication was because they love working with this wonderful group of EAAers who truly enjoy our hobby.

3. The donation to RAF of the income from paid lectures that I gave from '87 to '89 telling the exciting story of Voyager, RAF's most famous design (developed at RAF from 1982 to 1984).

The good news is that RAF still has potential to provide a few years more of support to builders - to maximize their chances of building a safe airplane and operating it safely.

The bad news is that RAF now is plagued by two lawsuits, both of which seem ridiculous, and both of which are proving to be very expensive distractions.

1. RAF contracted with Colin Chapman, the Lotus car founder, in 1982 to develop a proof-of-concept prototype to assess the feasibility of an ultralite-category light plane. The result (RAF model 97 Microlite) completed its contracted initial test program in 1983. The program was shelved by Lotus, primarily due to the death of Mr. Chapman. Rights to the concept were later sold to another English Company, Aviation Composites, which used the design's features as a basis for a different aircraft, the Mercury. The Mercury's development program suffered a number of developmental problems, among them, the failure to obtain an acceptable engine (the Lotus engine was dropped and others were too heavy for the configuration), and the discovery that changes would be necessary to obtain adequate spin recovery characteristics. Aviation Composites then discontinued further development and sued RAF claiming that we should have more thoroughly tested the model 97 in 1983 to find a possible flaw in spin recovery. This case is scheduled for trial in federal court during January '91. Of course there seems to be no basis, however, these exercises have an

enormous effect on our time and distract from our ability to concentrate on things more productive and enjoyable.

2. The latest lawsuit to be brought against RAF concerns the VariEze accident described in CP61 page 9. We did a thorough investigation of that accident and came to the conclusion that the wing attach taper pins, which were home-made, were a poor fit. The bolts that secure these taper pins were too long and all had had a threading die run onto them to increase the length of threads on each bolt! Aircraft bolts are roll threaded and heat treated. Under no circumstances should an aircraft bolt have threads extended or cut using a die! One of these bolts was missing as were the two taper pins. The three remaining bolts had been over-torqued allowing a wing to swing aft. The VariEze was seen to be doing aerobatic maneuvers by at least one eyewitness just prior to crashing. The pilot was found to have alcohol in his bloodstream. In spite of these facts, RAF and the builders estate are being sued by the relatives of the passenger.

It seems unreasonable that these suits are allowed to threaten the viability of RAF and, thus, its ability to continue to provide support to EZ builders/flyers. We, of course, do not plan to accept any settlement offers on these suits since bowing to extortion in order to avoid the hassle only attracts other frivolous suits.

YOU MUST REGISTER YOUR PROJECT.
YOUR LICENSE TO BUILD WILL EXPIRE 1 JANUARY 1991.

RAF ceased licensing builders in July '85. Our decision to remain open to support builders was based on our desire to not strand those who had been recently licensed. We did not foresee that now, more that 5 years after the last license, new building starts would still be occurring. In order to continue to be able to provide support for those who obtained a license with an honest intention of building, we must now place a limitation on the exercise of your license to build. Of course, it is not reasonable for any contract, especially one in which support is expected, to be good forever.
We must, therefore, cancel your license to build a RAF design unless you show that your building project is started by Jan. 1, 1991 and

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completed by Jan. 1, 1993.

We think you will agree that RAF has extended free support far beyond that expected of a company departing from the business. Between now and Jan. 1, 1991, RAF will compile a list of active projects with proper licenses to build so we can define those projects who are authorized and who deserve our support. By 1 January '91, you must fill out the form below and mail it to RAF along with proof that your building project is underway - a receipt for purchase of materials will do.

_____

NAME_____TYPE A/C_____

ADDRESS_____

DATE LICENSE AGREEMENT WAS SIGNED_____

SERIAL NUMBER ASSIGNED_____

DATE CONSTRUCTION STARTED_____

DATE OF FIRST FLIGHT
(OR PLANNED DATE)_____

N-NUMBER_____

_____

THIS SURVEY IS IMPORTANT as it will allow us to determine what projects are being conducted by legitimate, licensed manufacturers and which projects have been dropped. This will allow us to continue to provide quality support to those who deserve it.

Please fill out the form even if your aircraft is flying (no materials purchase receipt required). In this way, we can define our support requirements for the future. If RAF does not receive the form, we will assume your project is dropped, your license expired, and you no longer require support. RAF may assign new serial numbers based on the active list as of 1 Jan. '91.
Our main concern is the safety of those who fly RAF designs and we will continue to disseminate information pertinent to the safe operation of all RAF designs until we run out of resources to provide this support.

We believe RAF has provided the best support in the industry and we will continue to do so for as long as we can. As far as we know, no other homebuilt plans or kit manufacturer has provided any support after they stopped marketing their product. We are proud of our record and are proud of the thousands of builders who have completed their projects and who now fly them safely, efficiently and enjoy the full potential of the various RAF designs. BURT RUTAN

EDITOR'S CALL FOR HELP!

I would like to make a plea to all flyers of Rutan designs to please send me all reports of any failures, breakdowns, wear problems, anything at all that you think may be helpful to other operators of the same aircraft. Please write a clear report on the subject. Include your own ideas as to what caused the problem as well as what you did or would like to do about the problem. I will do my best to publish anything and everything that might concern operators of the RAF designed aircraft.

Examples of what I am looking for are in this very newsletter. The crumbling polyurethane fuel lines on a 10 year old VariEze, and the throttle springs wearing through an aluminum bracket due to vibration. As the fleet of RAF designs gets older and gets more time on it, various pieces on these airplanes are bound to show signs of wear and tear. I would like to accumulate as much of this kind of required maintenance information as possible and publish it in the CP.

Not just wear and tear items, any item that requires your attention is worth jotting down and sending in to RAF. I may not publish every item, but you can be sure that each will be carefully and individually considered. I look forward to hearing from you soon.

OSHKOSH 1990

Burt traveled to Oshkosh this year in his Catbird via Dallas, TX where he had a business call to make. He left a couple of days early from Mojave, had excellent weather and good tailwinds all the way. Sally was unable to attend Oshkosh this year, so Mike flew their Long-EZ, N26MS, with ARES crew chief, Fred Kimmel, in the back seat

Mike and Fred departed Mojave before dawn on Thursday, July 26th and flew toward Oshkosh using Mike's new King KLN-88 loran. They had excellent weather and good winds. They flew to O'Neill, NB where they stopped for lunch and fuel. They called Mojave to find out how Doug Shane, who was flying the ARES jet, was doing. Doug had just called in and reported that he had a problem and had landed at Wichita, KS.

Mike and Fred took off and flew south to Wichita where they found that Doug had already rounded up some help from local Pratt and Whitney people. There were lots of folks looking at the ARES and discussing what might have caused the problem. Doug had flown from Mojave at 25000 feet to Wichita. The outside air temperature was below zero Celsius. He noticed a drop in engine RPM which slowly degraded until he had only idle power. He shot a simulated flame out approach at Wichita and landed uneventfully, but naturally, was reluctant to take off again. The general consensus was that he had had water in the fuel which had frozen and clogged the fuel filter and this reduced the flow of fuel to the engine. A full power run-up on the ground showed full power was available, so it was decided that it must have been ice in the fuel which must have melted in the heat on the ground at Wichita. Crew chief Fred carefully checked the ARES and declared it fit to fly. Doug blasted off in ARES and Mike and Fred followed as best they could in N26MS. The two airplanes maintained radio contact all the way to Oshkosh. While they were on the ground in Kansas, the weather had degraded and both had to make several 180o turns and, also, were forced to do some considerable scud running to make it to Oshkosh. Doug elected to land at Iowa City, Iowa to top off his fuel so both arrived at Oshkosh at approximately the same time. The ARES ran flawlessly from Wichita to Oshkosh so the crew assumed that the problem had been correctly diagnosed.

ARES was parked on the new concrete ramp next to the immaculate Confederate Air Force's B24 Liberator and near an F-14 and F-15. The Stealth F-117A was parked nearby. Someone from the crew of ARES was at the airplane to answer questions virtually the entire time the airplane was on display.

Mike flew the ARES on Friday, Saturday and twice on Sunday. Doug flew ARES back to Mojave on Tuesday with Mike and Fred following in N26MS. The two aircraft stopped for fuel and a delicious lunch at Denver's Centennial Airport - a great place to stop, by the way. Excellent

food, super service and friendly people. From Centennial to Mojave, the only notable things were the turbulence and the headwinds. Other than that, both aircraft made it to Mojave safely and in time for an important business meeting.

RAF shared their booth this year with Larry Lombard and Michael Dilley of FeatherLite as well as with Mike Clark who had an interesting moving map display. This promises to give control back to the pilot and takes the ground controller out of the loop when it comes to potential mid-air conflict. A much better system than what we have now! Scaled has since provided storage and hangar facilities for Mike Clark's group while they tested and showed his anti-collision system to FAA and the people at Edwards.

Burt gave a number of talks at the various tents. All were well attended and we got to meet and talk to many Viggen, EZ, Defiant and Solitaire builders and flyers at bull sessions as well as at the ARES - and just walking around. According to Burt's mom, Irene, there were 78 RAF designs in attendance at Oshkosh, Not as many as we have had in the past, but still considerably more than any other designers airplanes. This year there were some truly outstanding examples, a fact born out by the convention judges who picked Bob Eckes' Long-EZ (built by George Nopper)

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as Grand Champion and Bob Greider's Long-EZ as Reserve Grand Champion. Herb Abrams' beautiful Solitaire won two trophies, the Stan Dzik Award for his very clever engine retraction-extension system (this had to be seen to be believed!), as well as a Lindy trophy for champion homebuilt. Congratulations to all the winners at Oshkosh, and congratulations to all who flew their own creations into the convention. A special congratulations to Ron and Pam Smith for finally completing and flying their beautiful VariViggen to Oshkosh. This really is a pretty example of the breed. David Orr assisted Mom Rutan in her count of all the RAF-types and he came up with the astounding statistic that the sum distance flown to and from the Oshkosh convention by all in their RAF designs was over 144,000 miles!

LANDING LIGHTS AND COCKPIT NIGHT LIGHTING.

Why does the Long-EZ have its landing light where it is? Initially, the prototype Long-EZ had no landing light. It also had no navigation or strobe lights. When Dick Rutan wanted to try for the Closed Course Distance Record in the C1B class, it was obvious that night lighting would be required. Dick and Mike hurriedly designed, built and installed a "fold out" type landing light under the right thigh support which was somewhat similar to the present plans call-out for a Long-EZ.

The light worked quite well, but due to its design, it was difficult to extend and it took up storage space under the thigh support. This led directly to the present landing light design. While there are probably a lot of EZ drivers who have landed their EZ's at night, there are probably a lot more who have not.

There are several requirements for an effective landing light on an EZ. One of the most important is that it have the capability to be correctly pointed for landing and then re-positioned for taxiing. An EZ approaches to land, nose high. The Cessnas and Pipers that many of us learned to fly in, do not. Due to their flaps, they normally approach nose down. This means that a landing light on an EZ must point down to a much greater degree than the light in a Cessna. Once this angle is determined (by trial and error), it will be immediately obvious that this light is now essentially unusable for taxiing since it points at the ground directly in front of the nose of the aircraft and the pilot can only see forward for about 6 to 8 feet. If this light is adjusted to make taxiing possible, it becomes useless for a landing light. That is why it is adjustable and must be adjustable at least to these two positions.

This pretty well eliminated using the nose mounted landing light that Burt had called out for the VariViggen back in the early '70's. Some VariEze builders did use this type of light but not many used it to actually land at night. Those who use it regularly found they needed to have a two position adjustment, usually a cable driven, difficult-to-design and-build device.

A number of EZ's have the landing/taxi light mounted in the leading edge of the outboard fuel strakes. We rejected this idea very early on because we were concerned about these lights reflecting on the canard, lighting up the canard and blinding, or at least hurting, the pilots night vision. This editor would welcome constructive comments based on actual experience using this type of landing/taxi lights. One definite advantage would be to make it easier to flash a landing light while flying at cruise speed.

Using the Long-EZ plans landing light requires some practice and a couple of little tricks only learned by experience. If you have never used your landing light at night, you are in for a surprise! The first time you turn it on and extend it, it will probably light up the interior of the front cockpit! It will tend to blind you by glaring off the nose gear strut into the little plexiglas window between your legs. Here are a few ideas to help you with these problems.

First of all, you should paint the inside of the nose wheel well flat black. Also, the inside of the trough where the nose gear strut fits while the gear is retracted should be painted flat

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black. The aft face and both sides of the nose gear strut itself, including any nose gear doors or covers should be flat black. Make a small cover (a piece of engine baffle rubber works quite well) that can quickly and easily be installed over the plexiglas window through the lower instrument panel. Velcro works really well here. Do not permanently cover this window. For daytime and night flying, this window can save your butt by allowing the pilot to verify that the gear is indeed down. Extend the nose gear, extend the landing light, verify that the gear is down, then install the window cover to completely block any light. With the landing light on, you should get no reflected light through the plexiglas window or through the fiberglass

wheel well. If you do, take whatever steps it requires to correct this.

The above evaluation should be conducted on the ground, at night. Before you go flying at night, you should address all of the above suggestions and satisfy yourself that you are comfortable with the landing light's effectiveness. Focus the light to an optimum taxi position and practice taxiing at night. Keep in mind that you will have to depress the light considerably from the optimum taxi position to the optimum approach-to-land position.

This editor has logged over 300 hours of night flight, many of those hours in a Long-EZ. The way I use the landing light is as follows: I slow to about 100kts on base and extend the landing light to what I feel is about the correct position. Once established on final, I fine-tune the landing light until I can plainly see the runway numbers illuminated by the landing light. (Mine is a 250 watt light and, as such, easily lights up the approach end of the runway). I continue to slow to reach touchdown speed just above the runway. I use a small amount of power right to touch down and I drive it on, rather than, flare for a "greaser" type landing. This avoids the problem of dropping it in and it also helps keep the landing light focused on the runway and not up in the sky (as it might be with a very nose high, fully flared touchdown). Once the nose wheel is rolling on the ground, I readjust the landing light to clearly illuminate the runway/taxiway in the 3 point position. So much for the landing light - if you have only a 100 watt light and you do actually fly at night, you should replace the 100 watt with a 250 watt. 14v 250w #4313, 28v 250w #4587.

Now to address the instrument panel lighting. An airplane with a canopy rather than a windshield presents a rather more difficult cockpit lighting problem due to the "fish bowl" affect. This is the result of all the panel light being reflected in the bowl shaped canopy and making it difficult to see outside. In this editor's opinion, the very best form of instrument lighting (to help cut down the fish bowl affect) is internal lighting in each instrument. Unfortunately, this is not available on most aircraft instruments but you should use it where possible such as VOR heads, engine instruments, etc.

The next best lights, I feel, are post lights. The least desirable form of lighting would be a flood light. A good dimmer switch is important, particularly when you are taking off or landing and need to maximize your ability to see outside. Dim the instrument panel lights down as much as possible while still being able to read the critical instruments. With post lights, there should be two to each critical flight instrument - airspeed, attitude, altimeter and rate of climb. These post lights can be turned to focus their small red glow to best illuminate each instrument.

Now, sit in your airplane at night with the canopy closed. You may be surprised to see just how much reflection you have in the canopy. You should obtain a piece of cardboard or fairly stiff paper, painted flat black, and cut it to closely fit into the forward end of the plexiglas canopy at the bottom edge of the plexiglas (where the plexiglas is retained in the canopy frame by fiberglass). You should ideally be able to secure this stiff paper in place with velcro or something similar. While seated in the normal position in the seat with the

canopy closed, your eye should see only the aft edge of this cardboard or paper. It must not

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restrict your view of the instrument panel or your view outside through the canopy. You should now have zero glare or "fish bowl" affect on the canopy. Cut the aft edge of the flat black cardboard away as much as you can to give you more physical room but not so much that you get the glare on the canopy. This must be done at night with the cockpit lights on. You should experiment, by trial and error, until you get it right.

All this may seem like a lot of trouble to go to but, believe me, if you plan on flying your creation at night, you will be very glad you took the time. Just be sure that this paper glareshield does not restrict your visibility of the instruments or of the outside. It should be soft enough to collapse out of the way in the unfortunate event of an abrupt stop or accident.

One other point. Flying at night can be a beautiful experience. It can also become a terrifying and dangerous experience if anything at all goes wrong. Flying a single engine at night is considered by many to be an unacceptable risk. Away from an airport, an engine or prop failure at night will almost certainly result in an accident and the chances of surviving an off-field landing at night are so small as to be essentially non-existent. This is a decision you, the pilot, must make. The information in this article is to assist you should you decide to fly at night. It is absolutely not intended to encourage you to do so.

PLANS CHANGES/INSPECTIONS

VARIEZE MAN/GND

Polyurethane fuel and vent lines. Mandatory Inspection before next flight - See article on this page.

Throttle/mixture springs. Mandatory inspection next 10 hours - See article on page 13.

Note: The headrest in a VariEze is not a structural roll over protection. See this page.

LONG-EZ MAN/GND

Polyurethane fuel and vent lines. Mandatory Inspection before next flight - See article on this page.

Throttle/mixture springs. Mandatory inspection next 10 hours - See article on page 13.

NO DEFIANT CHANGES

NO SOLITAIRE CHANGES

Please submit any significant plans changes that you may come across as you go through the building process.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help.

HEADREST/ROLL OVER

The FAA has requested that RAF make it clear to all VariEze and Long-EZ builders that the triangular shaped foam and fiberglass headrest on top of the front seat bulkhead is just that, a headrest. It is not a roll over structure. It will not support the loads that would be imposed on it in the event of an accident in which the aircraft might flip upside down. The construction of the headrest triangle is such that it is a lightweight, stiff "box" that makes an excellent storage area for maps, logbooks, etc. and, with a cushion attached to the forward face, it makes for a comfortable place to rest the back of your head when flying. The light weight foam and glass structure can not possibly support any turnover crash loads. As the builder/pilot of a VariEze or Long-EZ, you should be aware of this important information.

VARIEZE POLYURETHANE FUEL LINES

A VariEze builder/flyer recently reported to RAF that while conducting an inspection of his VariEze, he found all of the polyurethane

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fuel lines in his VariEze were cracked and when he squeezed these lines in his fingers, they crumbled to pieces. This VariEze is 10 years old and has been flown fairly regularly.

He has removed and replaced every piece of the urethane fuel line. This is a serious matter and for that reason RAF is making it a mandatory requirement to carefully examine every inch of urethane fuel line in all VariEze's. Use a strong light to check for cracks or crazing and squeeze the line at the same time. If the normal resilience is not felt, if the fuel line feels stiff or has any sign of checking, cracking or crazing, it should be removed and discarded. Any fuel lines forward of the firewall could either be soft aluminum tubing, using AN fittings, or as an option, could be new fuel compatible clear polyurethane tubing, or transparent yellow Tygon tubing. McMaster-Carr Supply Co. sells both of these products.

Any fuel or vent lines aft of the firewall should be stainless steel tubing or firesleeved aircraft-grade fuel line, such as Stratoflex stainless braiding over teflon tubing with stainless end fittings. Under no circumstances should there be any urethane or rubber hose in the engine compartment and all fuel hoses in his area should be protected by installing fire sleeve.

ACCIDENT DATA FOR HOMEBUILT "EZ" TYPE AIRCRAFT

RAF recently received a summary of all reported accidents during the period from 1983 to 1989 for various selected homebuilt aircraft. This

document was put out by the NTSB and is indeed a very sobering document.

Since there are more EZ's flying than any other type of homebuilt, it was to be expected that there would be more EZ accidents. According to this report, there have been 71 accidents during this time period and, of these, 24 of them were fatal accidents (or 33.8%). Thirty-three of these accidents were caused by mechanical failures of one kind or another while 38 were caused by pilot error.

The pilot error accidents are to be expected. Even factory built, certificated airplane accidents are mostly caused by pilot error. The unsettling thing is the very high rate of accidents caused by mechanical failures. In certificated aircraft (factory built), mechanical failures account for only 1.6% of all accidents. In homebuilt aircraft (not just EZ's, but all homebuilts), mechanical failures account for 19% of the accidents. With the EZ-type aircraft, 47% of all reported accidents from 1983 to 1989 were caused by mechanical failures.

While it will always be difficult to control the pilot error-type accidents in any type aircraft, as responsible builders of homebuilt aircraft, we need to be more aware of the things that can cause mechanical failures and possibly lead to accidents. Some of the mechanical reasons pointed out in the NTSB report are as follows: Mud wasp plugged fuel tank vent, Contamination in float bowl, Teflon tape in float bowl, Propeller failure/loss, Water in fuel, Drain not installed in lowest point, Carb ice/carb heat inadequate, Throttle spring failure, Canopy not latched, Grip came off control stick, Crankcase breather kinked (blew all oil overboard), In-flight fire, Improper wing incidence, Landing gear improperly installed (attach tab), Excessive connecting rod bearing wear.

You will note that only one of the above was an actual mechanical failure of the engine. All of the rest were simply caused by mistakes made by the builder and, essentially, all could have been eliminated by a careful, systematic approach to the important tasks of building and flying your own aircraft.

The only pilot oriented reasons called out by the NTSB report were: Careless hand propping, Lack of training (familiarity with type), Fuel mismanagement and Failing to extend the landing gear. From our own investigations of EZ-type accidents, we know that low flying, buzz jobs and low level aerobatics account for an abnormal number of accidents.

As always, the only reason we publish information of this nature is in the hope that

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it may help prevent more accidents.

SHOPPING

VARIEZE INDEX TO THE CANARD PUSHER

Bill Greer, a VariEze builder who became frustrated with looking for information in the newsletter, decided to do the research and compile an index specifically for the VariEze references in the Canard Pusher from CP10 through CP64! He has now completed the project and sent a sample of it to us at RAF to evaluate. It must have been quite a task. There are over 1100 listings in more than 50 pages. There is also an optional floppy disc for those who have personal computers.

For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. Bill tells us he plans on updating the index once a year which would make this a valuable reference source for anyone building a VariEze.

Bill has listed all of the plans changes printed in all the CP's as well as all suggestions, problems, etc. that Bill, as a builder/pilot, thought might be of interest to a fellow builder. If you would like to order a copy for yourself.

Contact: Bill Greer
222 McLennan Dr.
Fayetteville, NY 13066
315-637-3795

If you have oil leaks in the area of the rocker covers on your engine, Mike Melvill strongly recommends the use of silicone rubber, reusable gaskets manufactured by the Real Gasket Corp. Mike first tested these gaskets a number of years ago on his VariViggen. They completely eliminated all rocker cover oil leaks. Since that time, these gaskets have been installed on Mike's Long-EZ and Burt's Defiant with the same excellent results, namely zero oil leaks. This is one product that really works. Be certain to follow the installation directions exactly to obtain the best results.

Contact: Doug Price
Real Gasket Corp.
PO Box 1366
Laurel, MS 39441-l366
1-800-635-REAL
1-601-649-0702

PROPS FOR EZS AND DEFIANTS

RAF recommends the following prop manufacturers:

Ted Hendrickson
PO Box 834
Concrete, WA 98237
208-853-8947

Bruce Tifft
B & T Props
75875 Mosby Creek Rd
Cottage Grove, OR 9742
503-942-7068

NOSE GEAR "RATCHET" CRANK

Dr. Curtis Smith of Wooster, OH has developed a neat little method of assuring that the nose gear on a VariEze or a Long-EZ remains securely locked in both the gear-up and the gear-down position. This editor has already recommended this nose gear crank ratchet in CP ? last year. That recommendation was based on a description and photo of the mechanism.

Recently we had the opportunity to help install one of Curtis Smith's little gadgets and to see just exactly what it was, how it worked and how difficult it was to install. The installation went quite quickly and was not difficult. The only problems we experienced were that the existing Brock-supplied crank handle shaft was not a perfect fit in the inside diameter of the case-hardened gear and it was a tough job drilling through the hardened gear in order to install the required, and supplied, "split" pin. It took about an hour to complete the installation. The idea is to use a 1/4" ratchet wrench drive to lock the crank handle in the gear-up and the gear-down position. To crank it in the opposite direction, the pilot

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must position the little ratchet lever as required. It looks good and it works so well you wonder why you did not think of it! It is a marvelously simple idea and is a must for all EZ drivers. It virtually eliminates the concern of having the nose gear retract while taxiing or landing on a rough surface. It also ensures that the nose gear does not vibrate down in flight. This editor recommends Curtis Smith's clever idea without reservation.

Contact: Dr. Curtis Smith
5114 Canaan Center Rd.
Wooster, OH 44691

Enclose a check or $34.95 which includes shipping. Due to the machining and heat treatment required, allow 6 to 8 weeks for delivery.

LORAN INTERFERENCE PROBLEMS?

Mike recently installed a King KLN-88 loran in his Long-EZ, N26MS. At around the same time, he installed a new alternator because the old one stopped alternating! The replacement was identical in appearance but apparently something was different because the King did not work as well as his previous Northstar. After much testing and checking around, he was advised to install a Hisonic RFI-70 in-line noise filter. He obtained one through Pacific Air Radio in Van Nuys and installed it close to the alternator by cutting the main power wire from the alternator to the buss (battery) and running this wire through the Hisonic RFI-70 filter. The signal-to-noise ratios jumped up by a factor of 2! He is very happy with his King loran and recommends the Hisonic filter. They are expensive at around $100.00 ea. but are very effective. Dick Rutan has one installed in his Long-EZ with the same excellent results. Dick, in fact, was the person who advised Mike to try the RFI-70.

Contact: San Val

7456 Valjean Ave.
Van Nuys, CA
818-786-8274

or

Pacific Air Radio
16143 Waterman Dr.
Van Nuys, CA 91406
818-786-8800

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

WANTED

Complete or partial Whelen strobe set-up for Long-EZ: 2 ea. A600-PG/PR
1 ea. A413A, HDA, SF
1 ea. HD-60 installation kit.

Contact: Frank Nowak
Searle Road
Huntington, MA 01050
413-667-5595

FOR SALE

Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
230 Coachmans Way
O'Fallon, MO 63366
314-281-5851

Thanks for your generosity, John. We realize this is essentially a non-profit operation but it is a much needed service.

Crankshaft for Lycoming 0-235-L2C. 1000 hrs. total time. Magnafluxed. Mains polished to .003" under. Pins are within standard service limits. Cad plated and baked flange with service tag.

Dry vacuum pump, Airborne model 211CC.
Best offers to: Bernard Hayes
4305-D Westchester Dr. NE
Cedar Rapids, IA 52402
319-378-1331

New Stratoflex brake lines (stainless braided over teflon) 2 at 106" long each with dash 3 ends per Mike Melvill in the CP. Ordered from Aircraft Spruce, never installed, new cost - $235.00, sell for $200.00.
14 volt geared Prestolite starter - $190.00.
14 volt, 60 amp Chrysler alternator - $150.00.
Two prs. Sigtronics headsets plus a SPA-400 Sigtronics intercom - $500.00.
Contact: Hal Hunt
818-989-5534

Pair Cleveland 500-5 wheels, brakes and discs. Excellent condition - $200.00
Pair Cleveland 500-5 Wheels, brakes, discs, axles, axle nuts, tires & tubes, complete. Excellent condition - $350.00.
Oil pressure gage, Westach, no leads or sender - $25.00.
Mechanical tach - $30.00.
CHT gage, no lead or sender - $25.00.
Fuel pump, Facet, 12 volt - $25.00.
Fuel pump, Bendix, 12 volt - $25.00.
2 ea, VariEze or Long-EZ carb heat selector boxes - $50.00 ea.
2 Cessna 172 dry air cleaners - $5.00 ea.
2 Rosenhan master brake cylinders with reservoirs - $20.00 ea.
Pair Rosenhan brake assemblies - $100.00.

Assorted circuit breakers:

Pullable		Non-pullable		
1	35 amp	1	35 amp	
1	25 "	2	10 "	
2	10 "	5	5 "	
3	7 "	1	3 "	
4	5 "	2	2 "	$2.50 ea.

4 Assorted auto compasses - $5.00 ea.
1 Cleveland master cylinder - $30.00.
1 complete, new Whelen strobe assembly model #A413A HDA DF 14 14 volt four outlet - $175.00.
Contact: The Cutlers
PO Box 1058
Dublin. PA 18917
215-257-0817

61x66 B&T prop SAE 1 Hub - $250.00
62x66 Hendrickson Prop SAE 1 Hub - $250.00
6" Rotodyne Prop Extension SAE 1 to SAE 1 -$275.00
Sport Flight Exhaust System - $200.00

Contact: Pete Simmons
219 Pendleton Hill Rd.
North Stonington, CT 06359
203-535-2040

LETTERS

"Dear RAF,
Just thought I would drop you a note concerning a problem that I experienced in my VariEze on the way back from Oshkosh that might be of significance to other Ez's. Fortunately, the only harm done was a few minutes of inconvenience instead of what could have been a serious problem. I made a normal landing at Douglas, WY after a 4.5 hour flight from Duluth, MN. After rolling clear of the active runway, I found that advancing the throttle resulted in only a 100 rpm increase over my normal engine idle speed. Surprise! I had just successfully completed my first forced landing without even knowing it!

A check under the cowl revealed that one of the two throttle springs (the one with the most mechanical advantage, naturally) had cut its way through the aluminum bracket attached to

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a vacuum pump stud on my Cont. 0-200. The second throttle spring was within a whisker (a few thousands) of also cutting through the bracket. Wear at the other end, on the thicker (also aluminum) throttle bracket was quite evident but well short of failure. A check of all other engine related springs showed essentially no wear, so it is pretty obvious that my particular combination of throttle springs was resonating under the influence of the engine vibration, greatly accelerating the wear rate on these brackets. Total time on the installation was just over 800 hours. About 25 hours prior to the failure, I had switched back to a prop that I hadn't used for several years. If anything, this propeller runs smoother than the one that it replace, so I doubt that the "new" prop was a major factor. I would like to think that this problem developed after my last annual inspection (at 730 hrs.), but must admit that it looks like I missed seeing it despite the detailed check list that I use that explicitly includes all the engine controls and cables. I always go over the engine with a clean rag and (I thought) a sharp eye at every oil change looking for trouble, but didn't catch it at 765 hrs. either.

The following lessons suggest themselves to me:

1. Very careful attention to the condition of all engine related controls, as you have pointed out numerous times (e.g., CP61 pg. 7), is critical. A careful inspection of the engine, controls and exhaust system at every oil change could save your plane and/or life.

2. Ideally, the throttle and mixture controls should not require springs to open the throttle or enrich the mixture. This is difficult to accomplish with the Continental 0-200 using a single cable system because of the force required to overcome and positively actuate the accelerator pump.

3. Regardless of whether item 2 can be accomplished, springs are needed as a fail safe backup in case something else breaks (like the cable or outer cable clamp).

4. I believed that either spring alone was strong enough to actuate the throttle arm. With fuel in the carb, this wasn't the case. Instead of having a backup spring in case one failed, I actually doubled my chances of experiencing a throttle linkage failure by having two interdependent flight critical items. Obviously, other EZ builder/pilots need to inspect their particular installations to assure themselves that their controls will function reliably with any single spring failed. In my particular case, even if a single spring had been sufficient to open the throttle, only a few more hours of operation would have passed before the second spring also cut through the bracket.

5. Hindsight engineering makes is pretty clear that my brackets were plenty strong enough to carry the spring loads, but were not designed to withstand (or prevent) high rates of wear.

6. Finally, as my flight instructor told me long ago, "Don't count on being able to add power to make the runway."

To close on a more positive note, I love N862DP. So far it has made eight trips from San Diego to Duluth in nine years, with two side trips to Oshkosh, plus many other places all over the West. Last year I made it from here to Duluth with one stop in Rawlins, WY, and one-day trips over this 1500 nm route are the rule rather than the exception. Three years ago my daughter made the trip back with me when she was not yet five years old. I have and regularly use the Aerox system-it's great! Living in San Diego, I get lots of chances to climb out or land through our coastal stratus. So far, I have accumulated over 25 hours of actual IFR in N862DP. My plane does experience a definite pitch down trim in or near precipitation that requires significant retrimming.

This Spring I really enjoyed attending the EZ fly-in at Kanab, UT and Burt's birthday fly-in at Kern Valley (plus Oshkosh, of course). Enclosed is a picture of a flight of Southern Calif. EZ's returning from Kern Valley fly-in. Sorry I missed you at Oshkosh.

With best regards, Don Patch"

CP65, Page 12

THROTTLE AND MIXTURE CONTROL SPRINGS

Referring to Don Patch's letter above, we agree with Don's comments and we really appreciate his bringing this to our attention so that we can bring it to all the EZ builder/flyer's attention. As we have said many

times, having perfect control of your engine is just as critically important as having perfect control of your elevators, your ailerons and your rudders. Anything less is almost certain to cause an accident which could result in the loss of the aircraft and possible the loss of life.

The bracket that Don refers to is a 1/16" thick aluminum bracket which he had mounted on his vacuum pump pad. He had drilled several 1/16" diameter holes through this bracket in order to "hook" the two springs through the bracket. Over the 800 or so hours of operation, the vibration had caused these springs to slowly "saw" their way toward the edge of the bracket. One of the springs had, in fact, "sawed" through almost 3/16" of the bracket until it broke through the edge. The other spring was almost at this point.

While this method of attaching a spring works OK (indeed, it was the same method used on Burt's prototype, N4EZ), it is prone to this kind of vibration induced failure. A preferred method is to install an AN-3 bolt through the aluminum bracket with a short spacer. The spring should be installed so that the loop of spring is supported by the spacer. See sketch. **SKETCH OMITTED**

We have used this method successfully on several installations, some of which have been in operation for many years, with no failures.

The throttle and mixture both should be set up and adjusted so that they will work with no springs installed. The springs should be installed so that they pull the throttle to full power and the mixture to full rich in case of a cable failure.

These springs, cables and all engine controls should be carefully examined and checked for correct and full operation each time you remove your cowling, whether it be for an oil change or for whatever reason, or every 25 hours.

If you have these springs installed in a similar manner to what Don Patch had, you should check to see that you do not have the same failure, or close to failure, that he had - before next flight.

SOLITAIRE NEWS

SOLITAIRE OY-83X11 (FOR FIRST FLIGHT ONLY, OYXRT)

Kjeld Pedersen and Ole Ploug have completed the first Solitaire in Denmark. In fact, it is the first experimental glider ever to be registered in Denmark. We met with Mr. Pedersen at Oshkosh 1990 and he showed us a number of photographs of this beautiful Solitaire. We were surprised to learn that he and his partner, Ole Ploug, had been working with Herb Abrams, an Ohio Solitaire builder and designer of the Stan Dzik Award-winning engine installation in his own exquisite Solitaire. Kjeld also had the identical engine installation in his Solitaire. Kjeld made his first flight at a Denmark military installation using the Herb Abrams designed engine installation. This was on 7 July, 1990, only a couple of weeks after Herb made his first flight. Based on the photos we saw at Oshkosh, the attention to detail on Kjeld and Ole's Solitaire is impressive.

The KZ Rally in Denmark honored Kjeld and Ole by producing a commemorative stamp with their Solitaire depicted on the stamp Congratulations, Kjeld and Ole, we look forward to a more complete flight test report in the near future.

PHOTO OF STAMP OMITTED

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Kjeld Pedersen after his first flight in OY-XRT, a beautiful Solitaire Kjeld and his partner, Ole Ploug, built in Denmark.

Philip Neil Haigh's brand new Long-EZ recently flew in England. You have to see the incredible attention to detail in this plane to believe it.

Rom Smith recently completed this beautiful example of a VariViggen. He flew it to Oshkosh 1990 where Burt got to try in on for size.

Return to San Diego from Kern Valley, Burt's birthday party. Photo by Mike Romanowski taken from Don Patch's VariEze. N682DP, over Mojave.

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 66.
VariViggen (2nd Edition), newsletter 18 to 66.
VariEze (1st Edition), newsletters 10 thru 66.
VariEze (2nd Edition), newsletters 16 thru 66.
Long-EZ, newsletters 24 through 66.
Solitaire, newsletters 37 through 66
Defiant, newsletters 41 through 66.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00 When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every attempt to return your call between 3:30pm and 5:00pm (our time).

When writing to RAF, send along a self addressed, stamped envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

THE AVIATION COMPOSITES VERSUS RAF/SCALED LAWSUIT.

It has been almost two years since we were sued by Aviation Composites (a British company). We have had many letters of support and concern from you, the builders and flyers of RAF designed planes. We appreciate your support and are pleased to announce that on January 28, 1991 a jury in federal court in Fresno, CA returned a unanimous verdict in favor of RAF and Scaled on all counts. The federal judge absolved Burt and Dick of any blame and disallowed Aviation Composites claim for punitive damages before he ever gave the case to the jury! The judge also directed Aviation Composites to pay Scaled the unpaid balance of their account amounting to over $60,000.00.

All in all, from our standpoint, a satisfactory result. Unfortunately, an unbelievable amount of Burt's time, and several others at Scaled, was spent preparing for and during this trial.

RAF has felt from the beginning that this lawsuit was improper and without justification. Evidence presented at the trial clearly demonstrated that flight testing conducted by the law firm of Ervin, Cohen and Jessup of Beverly Hills, CA, under the technical direction of Ivan Shaw for Aviation Composites, produced results that confirmed RAF's innocence. These test results showed that RAF had performed the requirements of its contract with Group Lotus and had accurately presented the test results in the formal test report.

This lawsuit should never have been filed. RAF is investigating the potential for recovering defense attorney fees from Aviation Composites and the law firm.

Again, thank you, all of those who wrote and called during this tough and worrisome time.

RUSTY FOSTER - DECEMBER 1990

Rusty, a dear friend and a gentle gentleman, passed away shortly after Christmas after a short battle with cancer.

Rusty will long be remembered by EZ builders for his excellent modular designs. His side mounted electrical panels and his wiring were works of art. We will surely miss this versatile and knowledgeable man.

FLY-INS

KANSAS CITY GIG
"GRAZIN' IN THE GRASS"
A NATIONAL CANARD FLY-IN
JUNE 14-15-16, 1991

Put on by the Central States Association, this fun event will be held at the Johnson County Industrial Airport (IXD). Please write to Terry Yake, 8904 West 116th Terrace, Overland Park, KS 66210 for details. Mark your calendar, pickle-fork flyers, this will be a memorable event and is not to be missed.

1991 EZTER FLY-IN
TIFFT'S "BEND IN THE CREEK RANCH"
MARCH 29, 30, 31

Well, no doubt about it, the Hansen's annual Sedona Ezter Fly-In is going to be a hard act to follow. Since the Hansen's are unable to do the fly-in in '91, we'd like to carry on the tradition and have the get-together here at our new abode in Oregon. Cottage Grove is located just 20 miles south of Eugene. Nice airport and an FBO that is a real "nutcase" so he fits right in with our crowd. Since this is our first year here, we aren't sure about the weather, but are told it should be pretty nice by that time of the year. And after all, I do remember snow in Sedona one year. So we'll just "play it by ear" and plan on bright sunny days. We would appreciate having some idea of how many happy Ezers to expect so please let us know if you are planning to attend. We will be able to provide bedrooms for several couples and

can accommodate others if you would like to camp on some nice soft grass or throw a sleeping bag on the carpet. For those that prefer to motel it, we'll make up a list of local places to stay. We'll plan the usual agenda, dinner out for those that fly-in Friday, buffet lunch at the hangar on Saturday to greet those arriving, and dinner at our house Saturday night. Breakfast on Sunday at one of the local restaurants before departures. Can't promise anything as exciting as a session with the foot doctor (those that attended the Hansen's '90 fly-in will understand), but we'll think of something to do. Drop us a note or give us a call for more info or details. We look forward to sharing our new surroundings with our EZ friends. We think you'll like it.

Bruce & Bonnie Tifft
75872 Mosby Creek Road
Cottage Grove, OR 97424
503-942-7068

REVALIDATE YOUR LICENSE TO BUILD

As you know, in CP65, page 2, RAF requested all builders and flyers who were licensed by RAF to fill in a form and send it to us. This process is to revalidate your license to build. New builder fabrication starts were not allowed after 1 Jan. 1991. Please understand that RAF has extended builder support to those who purchased plans for a period far in excess of what any other company in this business has ever done.

We have received a total of 446 responses, 333 from Long-EZ, 79 from VariEze, 27 Defiant, 4 Solitaire and 3 VariViggen builders. This response is less that what we expected, ie, we believe there are more of you out there who desire to be properly licensed. Thus, we are extending the registration deadline to 3 months, to give those of you who failed to respond more time to do so.

Important - Register your building project and show proof that construction is underway by April 1, 1991 (see CP65). If you do not do this by April 1, you are not licensed to build a RAF design.

RAF cannot promise builder support for any project started after April. We do not consider it safe for anyone to build and fly any homebuilt without adequate support. Your are not protected by the AD (airworthiness directives) system like you are on a certificated, manufactured aircraft. We cannot validate licenses for any unsafe practice. Since we will have to drop support sometime over the next few years, the April '91 cutoff for builder starts is critical. While we can't predict the future extent of builder support, plan to complete your project by April

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'93. Those who respond by filling in the form and returning it to RAF will be considered by RAF to be legitimate and will be assigned new serial numbers. This will allow RAF to continue to provide quality support to those who deserve it.

ALERT! POSSIBLE CORROSION IN ELEVATOR TORQUE TUBES IN EZS.

We have one report from a VariEze builder/flyer who lives and hangars his EZ in Ohio. He noticed small bumps rising up on the top of each elevator along the aluminum torque tube. He could depress these bumps a little with his finger. He has removed each elevator and cut the glass and foam away along the top of each elevator, exposing the aluminum torque tubes. He reports that he has found "severe corrosion pits where each bump was located." We have not seen this corrosion yet - he is sending us a sample of the affected tube. We will report further in the next CP. He says that this corrosion occurs only under the foam and glass. These is no corrosion at all on the exposed ends of the elevator torque tubes.

Pitch control is absolutely critical to safe flight. For this reason, any report such as this must be taken seriously. All EZ, Defiant and Solitaire flyers should inspect the leading edges, the tops and the bottoms of both elevators for bumps such as we have described here, before next flight. If any evidence of bumps or corrosion is found, ground the airplane and remove foam and glass locally. Inspect the aluminium tubing under a bright light. Please report any problems found to RAF as soon as possible.

Any builders who have not yet built the elevators should treat the aluminum tubing with Alodine before starting on the foam and glass elevators. Do not omit this step! Remember, the corrosion, if it exists, is not visible on the exposed part of the tubing. It is under the foam and glass and cannot be seen without removing the foam and glass. Do not remove foam and glass without evidence of bumps or swellings that may or may not be soft. Do let RAF know of any evidence of corrosion.

The above report came out of Ohio where it is hot and humid in summer and cold and damp in winter. Anyone who lives where there is much humidity and/or near the coast should be especially concerned and should check the area called out before each flight.

We have checked all of the EZs at Mojave with no sign of any problems but that probably was to be expected, this being a desert with only a few inches of rainfall in a good year.

CAUTION

Check that what you order is what you get! Plastic fuel lines must be checked - often.

"Just re-read an article in the Canard Pusher about fuel lines in VariEzes. These "original call-out" urethane, flexible fuel lines have been reported to deteriorate over time and should be carefully inspected and replaced periodically. Unless the material for these fuel lines is the correct material, deterioration can be very rapid. Visually examining plastic tubing when it arrives from the supplier may not tell the builder/flyer that it is, in fact, the correct material. Even when the correct material is used, deterioration can occur and be invisible to all but an extremely thorough examination. Here is my experience:

Recently, I brought my VariEze home on a trailer and had it in the carport, nose down. It had been sitting there for quite some time

awaiting my attention. When I finally got around to it and opened the canopy, I smelled fuel but could find no sign of liquid fuel. Later, I was checking fuel lines under the rear seat by squeezing them with my fingers to determine hardness or brittleness when the header tank fuel line fell off in my hand! This was the source of the fuel smell. With the nose down, fuel had slowly leaked behind the rear seat bulkhead and into the rear cockpit. All of the other fuel lines were discolored to a dark brown but still felt pliable. In removing them from the fitting, to my horror, they easily split and crumbled.

I had always assumed that deterioration would occur in low spots in the fuel lines where water may collect. These failures, however, were up high at the aluminum fittings. They had been installed in July of 1983 and flown for a total of 750 hours, so they were seven year old. I have used auto fuel, regular, when at home and 100LL

Avgas when traveling. Lately, regular auto fuel is no longer available locally so I have been using auto unleaded (no alcohol). I have, on occasions, used Marvel Mystery oil as a fuel additive and, many years ago, I used TCP.

I believe that VariEze fuel lines should be changed at least every three years and great care should be taken to order the correct material. Also, make sure you receive the correct material. As a further safeguard, cut a few small pieces of the new fuel line and submerge some in a bottle of gasoline and some in a bottle of acetone. I check these samples from time to time for any obvious signs of deterioration.

Byron McKean"

Editors comment: Thanks for your report, Byron. We agree wholeheartedly with the suggestion to change plastic fuel lines at least every three years. Also, we have found that buying polyurethane-type tubing from a supplier like McMaster Carr (locations in Chicago, Los Angeles and New Brunswick, NJ) will get you a receipt that spells out part numbers. For example, according to McMaster Carr's catalog, Tygon tubing comes in at least two material types, one called out for fuel and lubricants, another for food and beverage! Each material has its own part number. Tygothane, the material originally called out in the VariEze plans, is recommended for fuels and lubricants. Using McMaster Carr, at least you have the verification of the part number on the receipt. We highly recommend this company as a source of an unbelievable variety of materials, tools, etc. Their catalog is an awesome tome!

CONTROLS CHECK BEFORE TAKE-OFF

An EZ pilot here at Mojave recently had an experience well worth relating and bears serious thinking about. He had had his canard off for routine inspection and maintenance and when he replaced it, he inadvertantly bolted the pitch control pushrod to the VECS12 arms incorrectly (due to a builder modification). This limited the nose down pitch authority but this fact was not discovered in preflight.

In flight, this pilot discovered that at full forward stick, his elevator was essentially even with the canard tip! Reducing power enabled him to descend and he was able to land without incident. What this tells us is to not only feel the forward, aft and left/right stops when checking controls prior to take-off, but to look at the control surface you are moving and verify that it is, indeed, traveling to what you know is the correct direction as well as limit. There is no substitute for a complete, full travel check of flight controls before take-off.

CAUTION

"Be careful about flying your EZ in a relaxed manner with your feet forward of the rudder pedals. On one flight, my shoe lace loop got caught over one rudder pedal and it took me 90 miles to work it loose. I now have on my checklist to stuff the loops in my shoes before I get into my seat.

Ray Mucha"

CYLINDER HEAD AND OIL TEMPERATURE CONTROL IN EZ'S

The problem is that the two rear cylinders run too cool and the forward two run too hot. After trying virtually every suggestion in the CP, and some others, with little success, Bill and Terry decided to do some serious testing and analysis of the problem. Using an airspeed indicator as a pressure gage (remember, an airspeed is simply an accurate pressure gage with the face marked in MPH or knots instead of PSI), six 1/8" ID clear plastic hoses were run from the cockpit aft through the firewall to various positions in the cowling. These hoses were numbered and tagged on each end and the cowling ends were reinforced with 1" lengths of 1/8" OD brass tubing and securely lashed to various supports as available. The six locations tested were the top and bottom of the left two cylinders (4 places), just inside the NACA cooling inlet (5th place), and right on top of the per the plans installed oil cooler (6th place).

It really takes two people to conduct this flight test. Data was taken at a range of airspeeds and altitudes with OAT, CHT on each cylinder, oil temperature and engine RPM recorded for each set of pressure (MPH) readings. These data were then

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plotted up on graph paper as a function of altitude on one graph and airspeed on another. Careful examination of the numbers and graphs revealed that under all conditions tested, the rear cylinder, bottom side, consistently had the highest pressure while the rear cylinder, top side, had the lowest pressure.

Assuming all cylinders are externally essentially identical, with new identical baffling at the time of the test, then each cylinder has the same inherent resistance to air flowing through the fins. The pressure difference, bottom to top, across the forward cylinders, was much lower than the pressure difference across the rear cylinders. This results

in much lower cooling air flow though the forward cylinders than the rear cylinders and, therefore, higher cylinder head temperature.

Almost all of the cooling air was going through the rear two cylinders. Basically, what happens is that the cooling air rushes in through the inlet, follows the bottom of the cowling as it swoops upward at the back till it hits the vertical rear baffle where this high velocity air is abruptly slowed down, raising its pressure. On the top side of the two rear cylinders, the lowest pressure exists due to proximity to the cowling outlet and the scavengering action of the prop. There is high pressure under the rear cylinders, low pressure on top and, presto, most of the cooling air flows through and around the rear two cylinders leaving the forward cylinders with less cooling air and much higher temperatures.

Obviously, the way to improve the cooling of the forward two cylinders was to increase the resistance to cooling air flow at the two rear cylinders. This was accomplished with some trial and error by installing temporary baffles forward of the vertical rear baffles under the two rear cylinders and cylinder heads to cover all but about 2" of the fin area of those two cylinders. With these temporary baffles wired in place, another flight test was conducted and instantly the CHT's were much closer to being even. One more iteration of even more restrictive, under-cylinder baffles permanently solved the cylinder head problem.

The oil temperature problem, however, still existed on this 0-320 powered Long-EZ. Many ideas were tried. Some helped a little but nothing cured the problem until a second oil cooler was added on the right side. A "brute force" method to be sure, but one that worked incredibly well, although not too elegantly.

We would like to thank Bill Freeman and Terry Yake (both Long-EZ builders/flyers) for the above information and we can verify how well this method works on CHT problems based on personal experience. With a little "cut and try", all four cylinders can be within a couple of degrees of each other in level flight. Some differences still exist while in a steep climb but small compared to what we saw before. Obviously, it is essential to have a 4 cylinder CHT gauge installed in order to safely conduct these tests. Also, very important: keep in mind that, depending on the condition of the engine, indeed of each individual cylinder, you may have slightly different baffling requirements for your engine, or even each cylinder, than someone else has. Approach this test methodically and you will have excellent results.

ED: BURT WANTED TO SHARE THIS LETTER WITH ALL EZ OPERATORS.

To: James Vliet
From: Burt Rutan
Subject: Your request for my comment re: Suitability of the Long-EZ for pylon racing.

First of all, please understand that I do not build Long-EZs. Each one is manufactured by a separate individual or group and he is responsible for determining what are the safe uses for his product. Each Long-EZ

is different since there are no conformal drawing requirements and no FAA conformal checks. I do have extensive experience in testing and operating my own Long-EZ. I do report the results of these tests, and operational experiences of others, via the owners manual and newsletters. This information is helpful to Long-EZ builders in deciding how to limit his operation, however, each builder/flyer has a different experience base and capability, thus each must decide for himself how to operate his own machine.

The information I provide shows operational limitations I have found to be safe for the Long-EZ using the Lycoming 0-235 or Continental 0-200 engines for gross weights up to 1425 lbs., speeds to 190 knots calibrated, and maneuver G's to 5.0. I have not operated the Long-EZ in pylon racing and thus, cannot recommend it per se. I do have a few reservations though, as listed in the following:

1. The forward-downward visibility and sideward-downward visibility is somewhat limited which could result in a mid-air collision when turning inside another pylon racer from behind or from one side. If I had designed the aircraft for pylon racing, I would have provided a more extended field of view.

2. Racing, by its nature, results in propulsion operation at the limits of capability, resulting in a significantly higher failure rate. This occurs when close to the ground. Thus, it is anticipated that engine-out landings will frequently occur. While the Long-EZ is a relatively good glider, its stall speed (56 to 65 knots depending on homebuilder variances) is relatively fast and thus, engine-out landings, particularly off-runway, will be hazardous.

3. Those who normally operate their Long-EZs as intended, ie, non-aerobatic, cross-country, efficient transportation, may be encouraged to operate beyond their capabilities after viewing a Long-EZ pylon race.

I am sure that with due consideration of all safety issues, the Long-EZ could be raced with a safety level similar to Formula One, however, that operation is considerably more hazardous then cross-country transportation and all involved must consider the hazards and requirements to fly with professional skills and attitudes.

Best wishes, Burt Rutan

ROCKER COVER OIL LEAKS?

Burt's Catbird, N187RA, had moderate oil leaks at all four rocker covers. This is an TIO-360, 210 hp, angle valve Lycoming. We removed the rocker covers and the standard cork gaskets had flattened down to nothing at each attach screw and all were leaking badly.

A call to Doug Price of REAL GASKETS initially caused a bit of confusion as to exactly what gaskets were required. Apparently this engine is an oddball, updraft cooled with inlets on the bottom and exhausts on top. Turned out Doug had the gaskets in stock. He shipped

them out UPS Red Label and we had them the next morning here in Mojave, in time to install them during lunch hour.

The rocker covers, themselves, were carefully scraped clean then polished with a Scotch Brite. The cork gaskets were peeled and scraped off the tops of each cylinder using a worn out wood chisel. This surface was then also polished with a Scotch Brite.

Now, and this is the critical part, we cleaned both surfaces with paper towel saturated in Acetone. (MEK would also be good). It is extremely important that all traces of oil are removed from the surfaces that these silicone gaskets will seat on, otherwise the silicone will extrude out from between the rocker cover and cylinder head. We used several fresh pieces of paper towel until there was no trace of oil. The screws were also cleaned in Acetone then each screw was treated with one drop of removable Locktite (Blue). The gaskets and rocker covers were installed and the screws were tightened with a large screw driver and a firm hand. (Don't know the exact torque, but the screws were tight). There should be no reason to have to keep tightening these screws each time you check in your cowl. If there are no oil leaks, leave these screws alone! Voila! No more leaks. Burt's Defiant has "Real" rocker cover gaskets, as does Mike and Sally's Long-EZ, and there has never been a drop of oil leaking from these rocker covers in over four years.

FOR SALE

Sport Flite Exhaust with carb heat muff, 175 hours - $100.00

Original carb heat valve from Aircraft Spruce - never used - $30.00.

Contact: Dan Worlz
818-366-8803

CP66, Page 6

Nose gear crank ratchet.

We cannot say enough about this truly clever device. Once you fly it, you will wonder how you ever did without it. It locks the gear in the up and locked position while in flight, and at the flip of a tiny lever, allows you to crank the gear down where the ratchet locks the gear into the down and locked, over-center position - no more chance of the nose gear vibrating out of the over-center position and stripping the worm gear. This gadget is simple, incredibly effective and easy to install

Contact: Curt Smith
5114 Canaan Center Rd.
Wooster, OH 44691
216-345-7721
Send a check for $34.95 to cover cost and shipping.

Center of gravity computer program.

Works on any IBM compatible - a neat, simple, "VariEze"-to-use program which instantly calculates your CG on a VariEze or Long-EZ and gives you a printout of the data. Jim has recently improved the program making it more user friendly. Send $5.00 and specify 5-1/4" floppy or 3-1/2" disc.

Contact: James H. Langley
245 E. Kimberly Street
Republic, MO 65738
417-732-1143

Heavy Duty Nose Gear Strut Spring

If your shock strut does not stay all the way up with you in the pilot seat, you may want to consider one of these springs designed and tested by Nat Puffer, designer of the Cozy. We are told by the people at Danley Die Set that the springs are still available and they do sell to individuals but need cash or credit card when an order is placed. Ask for Catalog #9-2416-36

Contact: Danley Die Set
3019 South Tanager
Los Angeles, CA 90040
800-243-2659

WANTED

Used Saf-T-Poxy Ration Pump.

Contact: Ron Ulbrich
2539 Camino Cabestro
Santa Fe, NM 87505
505-471-8148 (H)
505-471-3232 Ext. 230 (W)

AUTO FUSE USERS

Many builders/flyers are now using the small ATO or ATC auto fuses instead of the expensive, bulky aviation-type circuit breakers. Mike has used these for nearly five years in his Long-Ez with excellent service results. The only drawback is the fact that you have to remove a fuse to check it.

Well, that problem has just been fixed! EZ builder, Jack Mulqueen has sent us a stack of information on a direct replacement for ATO and ATC auto fuses which is a tiny resetable circuit breaker! The company is Snap Action, Inc. They currently have a $100.00 minimum order. The VB3-M circuit breakers cost $4.00 each in quantities of less than 100 and $3.05 each in 100 or more. They have a phone (201-654-4380) for information. The model we believe will work well is Snap Action Model VB3-M, a manual, resetable, push-in-type circuit breaker that is only a little bigger than the standard ATO auto fuse. Snap Action is also coming out with an even smaller model, the Mini Model "T". Not available yet but reportedly will be soon. Stay tuned.

SHOPPING

TSO'd, Silicon Rocker Cover Gaskets - to fit all models of Lycoming and Continental engines.
Contact: Doug Price
Real Gasket Corp.
PO Box 1366
Laurel, MS 39441-1366
800-635-REAL
601-649-0702

Canard Pusher Digest - Stet Elliott's Canard Pusher Digest for the Long-EZ is still available. The Canard Pusher Digest is basically a recompilation of information from CP24-CP65 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, See CP57). Note that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

CP Digest for the Long-EZ. $67.00
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel.
Annual Update subscription. $25.00
(4 updates)

Overseas orders add $5.00 for postage
Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

VariEze Index from CP10 through CP64 lists all plans changes as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. This index will be updated annually.
Contact: Bill Greer
222 McLennan Dr.
Fayetteville, NY 13066
315-637-3795

CHECK YOUR BELHORN PLANS

Some of the flush rudder belhorn plans shipped from RAF did not contain page A5. Please check your set of plans and notify us so we may send you the required page of drawings. We apologize for this error. (Joan did it).

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers: Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

WANTED

I am using a high tension hot wire designed by Tom Berkley who also supplied some components including the wire. The last known address I have for him is: A Berkley Design
PO Box 6184
Tehachapi, CA 93561
805-822-5065
I have sent him money for replacement wire, follow-up letters and phone calls. Tom does not seem to exist anymore. Does anyone out there know his whereabouts? Can anyone supply .041 diameter 17-7PH spring temper wire or its equivalent? I have been unable to find anything like it and all substitutes I have tried have failed - Help!

Contact: Randy Blanchard
2307 98th Ave., SW
Calgary, Alberta T2V 4S7
Canada

ED: RAF has received a number of requests similar to the one above. Anyone knowing of Tom's whereabouts or of a supply of the wire, please let RAF know.

NEW ELECTRONIC INSTRUMENT

RAF has received several enthusiastic reports on the Rocky Mountain Instruments Micro Encoder featured in Avionics Review, Jan. 1991. While we have not tested one ourselves, at least one EZ builder/flyer whom we trust is very excited about this instrument. Scaled Composites has ordered one. One of the engineers at Scaled will be putting the kit together and it will be installed in ARES, If it works well, it may be used in other Scaled test aircraft. Mike Melvill and Doug Shane will be flying the unit in ARES and we will publish a report about the Micro Encoder in the next CP.

It is a 3.2"x3.2"x7.5" box that fits into a standard 3-1/8" instrument hole and gives airspeed, altitude, rate-of-climb, outside air temperature and will connect to any transponder and altitude encoder. It also gives true airspeed, true air temperature and density altitude at the touch of a button. Many user-programable features, like Vne, Vno, max. gear extend, max. flap extend, stall speed warning. Also, selectable rate-of-climb from 1000 to 6000 feet per minute with trend indicators on airspeed and rate-of-climb. Sounds almost too good to be true! Stay tuned.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

VARIVIGGEN ------------ NO CHANGES
VARIEZE ---------- MANDATORY INSPECTION OF
LONG-EZ ----------ELEVATOR LEADING EDGES -
DEFIANT ----------SEE ARTICLE ON PAGE 2
SOLITAIRE----------THIS CP

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

A NEAT IDEA FROM KEN CLUNIS

This is my fix to keep the nose wheel from vibrating down inadvertently in flight. It also serves as a tire pressure gauge! The tire must roll over the 1/2 round, and the amount of force is proportional to the tire pressure. It works and is easy to make and install. **SKETCH OMITTED**

THROTTLE/CARB PROBLEMS ON A VARIEZE

"Dear RAF,

Enclosed is requested survey information on our VariEze, N222HK, SN 222. We are the original builders and continue to maintain and fly this thoroughly enjoyable aircraft. During our eight years of such, 222HK has proved to be remarkably free of serious problems. It has

flown five times Utica, NY to Oshkosh. There are a couple of things I would like to relate, however.

The most sever problem which I can recall was with the throttle carburetor control. Very small diameter portals built into the carb (Marvel Shebler mounted on a Continental 0-200) became clogged to such an extent that they created hydraulic back pressure on the primer piston. The result was very sluggish response of the actuator arm on the carburetor with the following consequences: Failure to provide adequate prime on opening the throttle, this made for hard starting. Failure of the two springs to quickly

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move the throttle arm to full open on demand, - a serious problem in the event of a go around. Failure of the cable to push the throttle arm to full open.

During servicing the aircraft, I noticed when opening the throttle using the control handle the cable actually buckled up and the arm did not move. Probably with the engine running vibration caused the arm to move slowly and would only be noticed in the event a sudden surge of power was demanded. I believe the change was a slow process and very subtle indeed.

Disassembly of the carburetor revealed the clogged portal and the fact that the fuel injection piston could not force a stream of fuel into the carburetor during prime. I do not know what material caused the clogging, perhaps a small residue of epoxy.

Whenever the cowl is removed, a simple check can be made to insure that the carburetor arm responds quickly when the throttle handle is advanced. It may take two people to do this.

A second issue involves small particle fuel contamination which has been virtually eliminated in 222HK by installation of an in-line auto fuel filter. We didn't like the heavy gascolator so installed three low point quick drains and the filter. The filter is a glass enclosed cylinder about 1 inch dia. x 4 inches long and easy to service. The clear glass allows visual inspection whenever the cowl is removed. We have found particulates such as Teflon, fiberglass and other unknowns in spite of thoroughly cleaning all tanks before placing in service.

As original builders, we greatly appreciate the tremendous job you have undertaken in keeping us informed. We have built two more aircraft, a Kitfox Model I and a Zenair STOL 701. Neither of these can compare with the service we have received from you. Please accept our heartfelt thanks and keep it going as long as possible.

Sincerely,
Charles M. Hewison"

EDITOR"S NOTE: We certainly appreciate Charles' experiences, but instead of the in-line auto fuel filter we would recommend a Kinsler in-line fuel filter. These are available from:
Kinsler Fuel Injection

313-362-1145
The filter assembly, part #9020, costs $85.00 and extra filters, part #9023, costs $8.00 each.

These are quality parts, machined from solid aluminum and have Dash 6 (3/8") AN flared fittings machined on to each end. The internal paper filter is replaceable (Kinsler part #9023) and can be cut apart to look for particulates at each annual. These filters are made for fuel injected ingines and work very well. Mike and Sally, Doug Shane and Dick Rutan are all currently using this in-line fuel filter.

P-LEAD TO MAGNETO INCIDENT

"Dear RAF,

I took a trip last August in Norse Nomad, my Long-EZ, which has over 400 hours to date.

I had an uneventful flight to McKinney, TX from my home in Carbondale, IL to visit with my son's family. On the way home via Texarkana and Little Rock, I suddenly experienced a noticeable drop in rpm. Since I had put in 20 gallons of 100LL before departing, I suspected water in the fuel. I did a 1800 turn and made it to an airport with the engine running rough and surging between 2400 and 2600 rpm's.

I removed the gascolator and found a half teaspoon of sand and sediment but no water. A quick test flight revealed that I had not found the problem. I decided to leave the Long-EZ, fly home commercially and return with a trailer. To make a long story short, when I got my Norse Nomad home, I started the engine and got a bad mag check on the right mag. The mags had checked perfectly on the previous two flights, but not now.

The culprit was a break in the shielded P-lead from the mag to the starter switch. where the wire made a 900 turn close to the switch. A single strand had cut the insulation and grounded the center electrode!

Knowing what I know now, I would have simply removed the P-lead from the mag and flown home.

This would have left me with a "hot" mag but it would have been much better than the 650 mile trailer trip! Also, I did not check the mags in the air when I had the problem. That check probably would have revealed the problem. A sudden loss of about 10% of your rpm is, in most instances, a magneto problem. Another clue was that the cylinder head temperature on my number 4 cylinder was unusually low. This plug runs off my right mag.

Hopefully, this experience may help other EZ flyers who may run into similar problems. Remember, any sudden drop in rpm, check the mags, if possible, check individual cylinder head temperatures, land and disconnect the P-leads. Watch out no one touchs the prop with the mags hot. This may get you home where you can affect proper repairs. Keep in mind that P-leads can shut you down if grounded! These wires should

be shielded and installed very carefully to minimize any chance of accidental grounding.

Greeting to all at RAF,
Jake Bach"

VORTEX GENERATORS ON CANARDS.

Since Magna Liset of Oakey, Australia reported on his epoch trip across Australia, we have had numerous requests for information on his modification (vortex generators).

Magna has been good enough to send us a sketch of what he did. Essentially, he glued tiny vortex generators (aluminum angles) to the top skin, forward of the elevators, approximately 40 of them on each side, at specific angles and positions This reportedly completely eliminated the annoying pitch trim changes he used to experience every time he flew into, or out of, rain or visible moisture. This was also done on the Voyager prior to world flight for the same reason.

The Roncz 1145MS canard will also achieve the same result but for anyone who might be interested in Magna's information, we can send a copy if you send a SASE with your request to RAF.

C BAYARD DU PONT'S DEFIANT
(RESEARCH NOT TESTED BY RAF)

Many CP readers will remember that Bayard had planned on installing Javelin Ford engines in his Defiant. Well, on August 28, 1990, Bayard made a successful first flight on his Defiant with Javelin Ford engines swinging 71" diameter by 82" pitch Sensenich wood props. Static prop rpm is 2200 hp. The Fords turn the props at essentially the same rpm as the Lycoming would, suggesting, obviously, that the Javelin Fords probably put out around 180 hp. However, the Ford engine weighs over 100 lbs. per installation more than a 180 hp. 0-360 Lycoming. That weight does include radiators and coolant.

Bayard reports that the engines run very smoothly and appear to cool OK. So far, he only has a couple of hours on his Defiant. He says the airplane flies well and his ground crew says that it sounds just like a P-38 Lightning!

Unfortunately, on the third flight, the front engine threw a rod totally destroying the engine. The resulting single engine approach and landing in the Defiant were no problem. Bayard had completely overhauled the rear engine but did not do the front engine. He feels that a nut came loose on one of the connecting rod bolts causing the problem. He has since obtained a replacement engine and is in the process of overhauling it. He is looking forward to flying his Defiant again soon and we look forward to a report on performance and perhaps a rundown of what the costs have been to get the Javelin Fords up and running in the Defiant. How about it, Bayard, a comparison of what the Fords cost compared to a pair of overhauled 0-360 Lycomings?

Congratulation, Bayard, on getting your Defiant in the air. As a flying testbed for an experimental engine, the Defiant probably is as reasonable a choice as you could have made.

ED: Note: Had this experiment been conducted in a single engine EZ, it would have almost certainly resulted in a serious accident.

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Peter Froidevaux from Switzerland sends in this picture of his beautiful Long-EZ and it's "smaller brother". The model has a 2.6 meter wingspan and is a prize winner in scaled competition. **PHOTO OMITTED**

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THE CANARD PUSHER No. 67 Apr 91
Published quarterly (Jan., April, July, Oct.) by

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805-824-2645

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Back issues	$ 3.50
Overseas	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 67.
VariViggen (2nd Edition), newsletter 18 to 67.
VariEze (1st Edition), newsletters 10 thru 67.
VariEze (2nd Edition), newsletters 16 thru 67.
Long-EZ, newsletters 24 through 67.
Solitaire, newsletters 37 through 67
Defiant, newsletters 41 through 67.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00 When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every attempt to return your call between 3:30pm and 5:00pm (our time).

When writing to RAF, send along a self addressed, stamped envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos.

LICENSE AGREEMENTS
Many of you have called RAF in the past month regarding your new license agreement number.. We ask your patience since the cut-off date has just recently been reached. After "digesting" the hundreds of forms that were returned, we will, indeed, issue new numbers to those of you who qualify for continuing builder support. It may take us a little time, but it will be done as soon as possible.

POND UPDATE
The challenge to break the world propeller driven speed record and win in the Gold Unlimited Class at the Reno Air Races was no small undertaking. Our contender, the Pond Racer, first took flight on March 22nd and has undergone six additional test flights as of this writing. So far, we have only about 10% of the development problems one might expect in such a project. The airframe and flying qualities have

proved excellent through the first seven flights, and already we have been to 290KIAS----Burt and his crew sure did a great job!

The racer flies like a pussycat and is very graceful on the ground even though it's a twin engine tail dragger. The airplane takes off and lands at 130KTS and we are doing wheel landings, holding the tail off till about 80KTS. Surprisingly, there is no loss of directional control as the tail touches down. Once on the ground, the steerable tail wheel is very positive. The hard idle prop drag is high and the braking is very good. One could operate the aircraft off a 3K' R/W comfortably.

We have increased the take off power to 42" of Manifold Pressure or about 350HP per engine; quite a bit of power for such a small aircraft (wing span just over 25 feet). Wing area just about the same as a VariEze!

Although the airframe is ready, we continue to gather data and re-work the engine software. Each engine is totally computer controlled and the programming will take more "fine tuning". These power plants are brand new to aviation and

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so unlike the antiquated airplane engines we have grown accustomed to.

The methanol fuel is also a challenge and has presented it's own unique problems. For instance, when the fuel gets into the oil, it has a tendency to "thicken up" and then blow out of the breather. To remedy that, the engines are preheated prior to each run. We have also run into hurdles with corrosion in the fuel system and must purge and flush each engine after every run up--whether we fly or not.

The Electramotive V6-30 engines are very special and must be preheated for an hour so we do not damage the close tolerance bearings. Also, at engine shut down the ground crew immediately blows air through the engine compartment to "quick cool" and to keep the heat from the turbo-chargers from soaking back into the composite structure.

The Pond Racer is a unique machine and requires a lot of care. There is so much power available (we are only using 40%) that the tail must be tied down for even a run-up. If the pilot exceeds 25" MP with the chocks/brakes on, even with full aft stick, it will nose over--bad news for props. We are currently running the low RPM flight test engines, turning each at 5600RPM while the props turn at 2050RPM through the gear box. The full race engines will turn 8000RPM for the same 2050RPM prop speed. At that time we can go to a full 1000HP and fly at record breaking racing speeds.

We are still in the very preliminary phase of flight test and have quite some way to go in building the speed to 430KEAS, but right now we are very pleased. See you all in Reno!

Dick Rutan

A LETTER FROM BURT

We print this letter in CP67 because it is a typical reply to many we receive and in the hope that it will clarify the situation.

"Dear Craig;

We confirm that our records do not show you as authorized to build a Long-EZ as you do not have a license from RAF.

No new licenses were issued after July 1985.

The person who sold you plans may or may not hold a license. If he does, he could contract with you, as he is an authorized manufacturer of a Long-EZ. If he, as the manufacturer, is willing to accept the responsibility of this aircraft and thus, in effect, sub-contract its fabrication to you, he may do so. However, be sure before you start, that he is willing a accept responsibility as the authorized manufacturer and is committed to providing support to you during your fabrication, and while you fly your aircraft. We, RAF, will support him (the authorized manufacturer) as long as we are able to do so.

We strongly recommend that you obtain a written contract with him to guarantee that you will be provided with support. It is not advisable, and may be extremely dangerous, to build an airplane referring only to plans and without the benefit of a safety information system. In effect, you would be doing a true prototype without benefit of experience of others.

Also, please see Canard Pusher #46, pages 9 and 10, and Canard Pusher #54, page 1 for further explanations.
Burt Rutan"

DEFIANT FLYER
A newsletter for the Defiant builders and owners is now being put out by Defiant builder/flyer John Steichen, 960 86th St, Downers Grove, IL 60516, 708-969-3535 (days), 708-985-6671 (nites) and Fax 708-969-4692.

John is taking over from Charlie Simms who has done such a wonderful job for a number of years but really needs to get serious about finishing his own Defiant.

John would like to hear from anyone who is building or flying a Defiant. This newsletter is

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an absolute must if you are currently building. John is an extremely methodical guy and is keeping an accurate list of builders' projects as well as flying airplanes. Help him to keep these lists as current as possible so that important information can be disseminated to the people who really need it. RAF wholeheartedly supports the job Charlie started and John has now taken on. We will do all we can to support them in their very noble efforts.

FLY-INS

KANSAS CITY GIG

"GRAZIN' IN THE GRASS"
A NATIONAL CANARD FLY-IN
JUNE 14-15-16, 1991

Put on by the Central States Association, this fun event will be held at the Johnson County Industrial Airport (IXD). Please write to Terry Yake, 8904 West 116th Terrace, Overland Park, KS 66210 for details. Mark your calendar, pickle-fork flyers, this will be a memorable event and is not to be missed.

Please let Terry know if you plan to attend. He needs to know in order to plan. He specifically is requesting the following information: Name, address, type of aircraft (if flying or building), aircraft "N" number, number of people attending and arrival and departure dates.

Shirl Dickey is once again planning a full program of R.A.C.E. (Rutan And Composites Enthusiast) events.

KANAB CANARD HONK-OUT
Kanab, Utah
May 25, 26 and 27

Aikens Lodge _ 801-644-2625 (25 rooms)
A & N Lodge _ 801-644-2420 (4 rooms)
Please make your reservation by May 8th, otherwise there is no guarantee.

Activities: Saturday night, barn dance at the Red Hill Convention Center. Sunday, race and awards banquet (Travelers Inn).
They have requested a Fly-by over their Memorial Day Parade as we depart the area Monday morning.

JACKPOT EZ BASH
Jackpot, Nevada
July 5, 6 and 7

Cactus Pete Resort and Casino - 800-821-1103
Please make your reservation before June 20th.

Activities: Friday evening, live entertainment in the Galla Room. Saturday, race and Special Guest cocktail hour (sponsored by Cactus Pete).

BONNEVILLE SPEED WEEKEND
Wendover, Utah
Aug. 31, Sept. 1 and 2

Stateline Inn - 800-648-9668 (Reserve early)

Activities: Saturday, entertainment. Sunday, race, awards banquet buffet in the Cobb Room.

HIGH POINTS AWARDS BANQUET & KILO TRIALS

Chandler, Arizona

Nov. 30 and 31

Chandler Inn - 602-963-6361 (reserve early)

"EAZTER" FLYIN - COTTAGE GROVE, OR
"A short report on the first ever Oregon "EaZter Fly-In". The "great spirit" of the sky smiled fondly upon us by providing gorgeous weather for our get-together. Although the group was fairly small, the "tall tales" were every bit as large as those told at the bigger fly-ins.

We had 8 EZs proudly displayed at the Cottage Grove Airport. Several builders drove in to get "reinvigorated" to get busy and finish their flying machines. Rides were given to the builders which is also a definite incentive to finish and fly EZ.

The weekend consisted of lots of hangar chatter; looking over innovative ideas on different airplanes; colored eggs; rides in a beautiful old antique Ford auto; watching a great video of a gorgeous house in Hawaii constructed by John Totah; and lots of eating. It was exciting for us to

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show off our bit of Oregon, and we're so grateful the weather cooperated.

We had several states represented--California, Nevada, Washington, and, yes, even Hawaii (these folks did travel via the big commercial bird). Attendees: Leonard Troutman, Dave & Liz Jones, Bill Therringer, Dwight DeBoer & Tsuruko (alias Suzi), Gus Sabo, Wayne Johnson, Phil Supan, Wes Lorier, Ed Hanley, John Totah, Bromwyn, Billie, Binky, & Chansel Denis.

It was a great mix of people and planes, and we thoroughly enjoyed hosting such a super group. Thanks guys! We also had several really nice telephone calls from EZ friends that couldn't make it to Oregon for the weekend. We appreciate the calls from Al & Mabel Coha, Al & Karen Dierksen, Wes & Millie Gardner, Jim & June Heitkotter, Mike & Sally Melvill, and Donald & Bernadette Shupe. We missed ya'll

This was a great kick-off for us for the '91 flying season, and we look forward to lots more fun get-togethers this summer."
Bruce and Bonnie Tifft

LETTER FROM VARIEZE FLYER
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours

(after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily. I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc. I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be. This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. I removed the small aluminum plate off my nose wheel years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. Don't trust anyone else with your safety. Fortunately, I have always had all caps safety wired with stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one through the prop.

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

CONTROLS - RIGGING
Both control sticks should be rigged approximately 10 degrees left of being vertical. A side stick should not be rigged vertical with ailerons at neutral. The 10 degree, however, is not critical. You should sit in your airplane and place your hand on the stick in a relaxed condition, such as you might experience while on a long cross country. You will find that the most comfortable position for you hand is a little left of the vertical. Clamp your stick in this position and check that the CS-124 belhorn is now vertical or exactly as shown on page 16-5 of the plans.

Now, rig your ailerons to fair with the wings (neutral roll). Adjust the CS-126 and CS-129 push rods to position the ailerons at neutral with the angle between the CS-128 belcrank and the CS-129 push rod at 90 degrees (see pages 19-5 and 19-6 of the plans). This is very important, do not omit this step.

Now, install the stop bolt shown on pages 19-5 and 19-6 of the plans to allow approximately 20 degrees of rotation of the CS-128 belcrank but, more importantly, to move each aileron up 2.1" as measured at the inboard trailing edge of each aileron relative to the wing trailing edge. Theoretically, the aileron should travel up and down equally but may not due to individual tolerances. Do your best to set each aileron travel equal at 2.1" in the aileron trailing edge up position and accept whatever you get in the down position. (Note: More than 2.1" travel will not give more roll authority due to flow separation on the ailerons {aileron stall}).

The stop bolt on the right side of the airplane (through the CS-127 brackets) should stop the right aileron at 2.1" trailing edge up. The stop bolt on the left side of the airplane should stop the left aileron at 2.1" trailing edge up. The sticks, however, should be able to travel further left and right than just to the point where the CS-128 belcranks strike against the stop bolts. It is very important that you can move the stick approximately 10 degrees more in each direction than what it takes to strike the aileron stop bolts. This is because the air loads on the ailerons will cause some "wind up" of the roll control torque tube.

In order to have the maximum available roll authority, you must be able to displace the ailerons to their maximum deflections (i.e. 2.1" of travel) at speeds up to the maneuvering speed, Va-120kts. Check to see that your hand wrapped around the stick does not strike the side of the fuselage when rolling right, and that the AN4-15A bolt and washer through the bottom of the front control stick does not strike the side of the fuselage when rolling left. See page 16-6, top left, of the plans and, if necessary, grind through the inside skin of the right side of the fuselage to allow over-travel of the stick (left roll) with full forward (as well as neutral and full aft) pitch control. If you are already flying your Long-EZ and do not have as good a roll rate as your buddy does, check the aileron throw and the ability of the forward

stick to over-travel both left and right to assure that you can deflect the ailerons to their stops at up to 120 knots.

Carefully check that you have the correct elevator travel and that the stick does not limit your ability to reach the elevator deflections by prematurely striking the console or any cover you may have over or around the control sticks. If you have the original GU canard, you should have approximately 22 degrees of nose up (elevator trailing edge down) and 18 to 20 degrees nose down elevator travel. If you have the Roncz 1145MS canard, you

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should have 30 degrees nose up and 12 to 15 degrees nose down. It is very important that you have pitch control stops set correctly to obtain maximum lift, and no more. (More travel gives less lift.)

Rudder travel is not as critical but, due to dihedral effect, the rudders on a Long-EZ add considerably to rate-of-roll. In order to obtain the maximum benefit from the rudders, do be sure that your rudder travel is set to the maximum recommended. (6" measured at the top of the rudder for the original plans-built rudders and for the new high performance rudders, 4-1/2" measured at the bottom of the rudder relative to the lower winglet trailing edge.)

Do not accept any friction in the pitch control system. If you have friction, do not fly until you have corrected this condition. Friction in the pitch control system of a canard-type such as a Long-EZ can make the airplane critically sensitive to fly. Friction in the roll control system greatly reduces the enjoyment of flying your Long-EZ and should be corrected. Work on every pivot and hinge point until the aileron control system is nice and free, with the minimum possible friction.

Your flight control system is absolutely critical to safe, controlled flight and, in this area more that any other, accepting less than perfection could be very hazardous to your health! Do not go flying until you are completely satisfied that you have done your very best to reach the above goals in the control system of your Long-EZ.

CAUTION
HAND PROPPING

"If your magnetos are not both impulse mags, be certain that you have the non-impulse mag turned off during hand propping. Lycomings usually have an impulse mag on the left and a non-impulse on the right. Small Continentals usually have two impulse mags. Check yours to be sure.

If you leave a non-impulse mag on while hand propping, it can result in a kick back with fingers in the way. I have personal experience with this. I had trouble starting one day so decided to use both mags. The resulting kickback caused a broken thumb and badly bruised fingers! Be careful."

Chuck McCleod

ED - We know of at least three EZ flyers who broke their hands the same way. One spent over $5000.00 in doctor bills getting his hand repaired! As Chuck says - be careful.

NOSE GEAR EXTENSION PROBLEM
"On my first flight, I left the nose gear down for the entire flight. When I attempted to retract the nose gear to park nose down, it retracted until the nose tire contacted the aft edge of the nose wheelwell then stopped moving! Turning the crank handle either way had no effect. On examination, I found that the AN-4 70AD4-10 rivets attaching NG60 to NG65 (worm gear to shaft) had sheared off! I am so happy I did not retract my nose gear on that first flight".
Jack Bennett
DeKalb, IL

Jack sent this note in because he was worried that the suggestion from Ken Clunis in CP66, Page 9, may cause more failures like he experienced. We print this information, like we do all of our hints and problems, in case they may help others. Let this serve as a warning to carefully check your rivets before next flight.

On the bright side, this is the first failure of this kind we have had reported. I checked on just our local fleet of EZs on the Mojave airport (at least 7 EZs as of April 1991!) with a collective total flight hours of 7668 hours! None of these have had this problem. Maybe Jack had some sharp edged holes or something - hopefully it won't become a common problem. Jack solved his problem by simply installing an AN-3 bolt in place of the rivets. An excellent fix if you find yours is loose.

Please report any failures like this to RAF so we can disseminate the information to the several thousand builders and flyers around the world.

EXHAUST SYSTEM CRACKS
We seem to be experiencing a rash of exhaust system cracks. After years of essentially no cracked weld or cracked pipes, suddenly, over the last year or so, we have received perhaps a half dozen reports - a couple in the last few weeks. A few have been Brock exhausts for Long-EZs, but most have been Sport Flight (Herb Sanders) VariEze as well as Long-EZ exhausts. Steve Franseen, VariEze builder/flyer in Denver had what he termed a Big Time Emergency when the outboard section of a Sport Flight VariEze exhaust system came off in flight and split the prop to the hub. He would like to warn builder/flyers to check exhaust systems very carefully around the welds. This is a real important preflight check item. With a pusher, a broken exhaust will almost always result in a forced landing.

Steve has requested information from anyone who is operating Sheehan Engineering piston and rings in an 0-200. His VariEze, N86EZ, has run without problems using these parts for over 2 years. He is interested in comparing information on higher time engines using this set up. Steve is also interested in sources for more of these high quality components. Anyone who would like to contact Steve can reach him at:
Steve Franseen

10196 W Keene Ct
Denver, CO 80235
303-987-1880 (H)

FOR SALE
LONG-EZ PARTS FOR SALE
Due to change in my flying priorities, I would like to sell all of the parts I have accumulated -new, never used- as a lot or on a part by part basis.

Contact: Allan Paige
165 La Rose Ave. Apt. 915
Weston, Ont. Canada M9P 3S9
416-248-8261

VARIEZE PROPELLER
Used, but in excellent condition - Hendrickson 56 Dia. x 70 pitch - $325.00

Slick magnetos (new) - model 4230 with impulses - $425.00 each.

Contact: Don Bates
2742 Swansboro Rd
Placerville, CA 95667
916-622-1886

SHIMMY DAMPER
As noted in a previous CP, Bob will not be continuing to sell his shimmy dampers. He says he has 19 left of the final production run!

These are the best shimmy dampers available - price is $71.48 per kit, delivered.

Contact: Bob Davenport
PO Box 650581
Vero Beach, FL 32965-0581
407-567-1844

SPRINGS FOR FLUSH BELHORNS
NOTE NEW ADDRESS AND PHONE
Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!
Contact: John York
921 College Rd.
Lebanon, IL 62254
618-537-2142

CP67, Page 7

NOSE GEAR CRANK RATCHET
NOTE NEW ADDRESS AND PHONE NUMBER
We cannot say enough about this truly clever device. Once you fly it, you will wonder how you ever did without it. It locks the gear in the up and locked position while in flight, and at the flip of a tiny lever, allows you to crank the gear down where the ratchet locks the gear into the down and locked, over-center position - no more chance of the nose gear vibrating out of the over-center position and stripping the worm gear. This gadget is simple, incredibly effective and easy to install

Contact: Curt Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

Send a check for $34.95 to cover cost and shipping.

RUSTY FOSTER'S SPACE SAVER PANELS
The mold for the Space Saver panel is now at FeatherLite. Larry Lombard and Mike Dilley can supply a panel should you need one.

All of Rusty's face plates, switches, circuit breakers, wire, etc. were purchased by Gary Bryant of Bryant Avionics, 2500 1/2 E Graves Ln, Carson City, NV 89706, 702-885-9919. Gary is more than willing to help - give him a call.

REQUEST FOR INFO ON TOM BERKLEY'S HOT WIRE SAW
Per our request in CP66, we have had one response from John Di Milia who has purchased a 220 foot roll of the .041 diameter high temp, high tensile wire from the manufacturer.

The 220 feet was a minimum order and John is willing to sell his extra wire. He purchased his wire from The National Standard Co., Los Angeles Warehouse, 14700 S. Marquardt Ave., Santa Fe Springs, CA. 213-921-9683.

Contact: John Di Milia
92 Park Ave.
West Caldwell, NJ 07006
201-206-4282

WANTED
0-200 with fuel pump, key start, alternator, mags and carburetor. Can be run out.

Contact: Don Moses
602-451-8880
(Ask for Don or Carol)

Rusty Foster Space Saver Long-EZ Power Panel.
Contact: John or Sandy Bakken
Rt 1 Box 85A
Pocatello, ID 83202
208-238-0754 (evenings)

FOR TRADE
Lycoming 0-320-H2AD (run out) for a Lycoming 0-235 with Dynafocal mount (can be run out).

Contact: Jacque Elliott
512-425-8913

SHOPPING

WICKS AIRCRAFT SUPPLY CO.
We have been asked us to let you know that they now carry in stock Real Gaskets, the 100% silicon rocker cover gaskets for Continentals and Lycomings. As we have said before, there is no better gasket and no better way to eliminate oil leaks at the rocker cover.

Also, Bud Meyers says they now carry the 5" axles (1-1/4" dia.) in a slightly longer version (6" instead of 5-3/4") to better fit the heavy duty Cleveland brake installation. They also have the wider spacer for the inboard side of the wheels to facilitate the use of the heavy duty brakes. These new axles have two cotter pin holes (at 90 degrees to each other) drilled in the threaded end. (An excellent idea. ED)

Bud has researched the Snap Action fuses and circuit breakers as mentioned in CP66 and has decided to stock the Snap Action MB-1. It is smaller and weighs less than other circuit breakers and is less expensive. Contact Wicks for more information.

AILERON/RUDDER HINGE RETROFIT KIT
The purpose of this kit is to effectively prevent additional wear on the aircraft hinges and thereby circumnavigating a time consuming hinge repair down the road. The hinge kit will fit any MS20001-P3, '-P4, '-P5, or '-P6 extruded aluminum piano hinge that is specified for use on the Long-EZ, VariEze, Defiant, Cozy, Glasair ailerons and/or rudders. You will be supplied with enough Teflon spaghetti tubing and a special high grade stainless spring steel wire for all the hinges used in the ailerons and rudders.

This hinge kit will work in an already worn hinge, but just how worn out (larger I.D. of hinge hole) remains a question we cannot answer. We believe the DuPont/Teflon tubing supplied in the kit will wear proportionally to the amount of space between the tube and the hinge. After more than four years there has not been any additional wear on any of the installed retrofit kits that we know of.

INSTALLATION: Mike Melvill and I found this retrofit to be a piece of cake, taking approximately 10 minutes for each wing. I enclose

detailed instructions with each kit explaining several different installation methods used by various builders.

I really don't believe you will have any questions, but just in case, you can call me anytime 0800 through 1700 hours E.S.T., Monday through Friday at 305-974-6610. Please identify yourself as an experimental aircraft builder.

Please note: These kits cost $21.00 US within the USA and Canada. Overseas, the cost is $25.00 US. All orders shipped in the 48 continental United States will be UPS, the rest are shipped by mail. Please add $2.00 US on Rutan Defiant Kits.

When ordering any of the kits, please supply the following information for purpose of giving you the proper kit supplies and providing emergency updates should that necessity arise. Shipping costs are included in the above prices.

1. Name and address. Kits cannot be delivered by UPS to a PO box. Address must be a physical structure. Please type or print clearly.
2. The serial number the kit designer has given you and your government supplied tail number,if you have them.
3. Phone numbers for both work and home, if that is at all possible or practical.
4. Type of aircraft, e.g., Glasair, Defiant, Long-EZ, etc.

Contact: Gary A. Hall
851 SW 63 Ave.
North Lauderdale, FL 33068
305-971-9731 (home recorder)
305-974-6610 (Parkson Corp)

CANARD PUSHER DIGEST

Stet Elliott's Canard Pusher Digest for the Long-EZ is still available. He has just published the 2nd edition which includes all pertinent information for CPs 24-65. The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

CP Digest for the Long-EZ	$67.00
Overseas orders add $20.00 for airmail, otherwise, it will be sent via surface vessel.	
Annual Update subscription. (4 updates)	$25.00

Overseas orders add $5.00 for postage
Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

VARIEZE INDEX
Lists all plans changes from CP10 through CP64 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. This index will be updated annually.
Contact: Bill Greer
222 McLennan Dr.
Fayetteville, NY 13066
315-637-3795

RAF "GOODIES" AVAILABLE

Tie tacs-Long-EZ/VariEze (gold or silver)	6.50
Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25

CHECK YOUR BELHORN PLANS
Some of the flush rudder belhorn plans shipped from RAF did not contain page A5. Please check your set of plans and notify us so we may send you the required page of drawings. We apologize for this error.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

VARIVIGGEN ---------- NO CHANGES TO ANY
VARIEZE ---------- DESIGNS THIS NEWSLETTER
DEFIANT
SOLITAIRE
LONG-EZ

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

EDITOR'S NOTE

Bruce Tifft tells us his prop making business is booming. He has found a new supplier who carries an even better quality wood than his usual high standard. The move to Oregon (along with an increase in customers) put him a little behind in filling orders , but he is diligently turning out props as fast as his quality control will allow. He asks your patience and, as always, will try to work with anyone who finds themselves in a hardship situation. B&T Props has always been one of RAF's recommended suppliers because of the Tifft's personal integrity and the good workmanship that comes from that shop.

NEWS OF A PROP SUPPLIER

We recently received several glowing reports from EZ and Defiant flyers about props they had purchased from Performance Propellers in Patagonia, Arizona. We wrote to Clark and Margaret Lydick, owners of this company and also Long-EZ builders and flyers. They used their Long-EZ as a flying test-bed for their props and have accumulated over 600 hours.

They make two and three-bladed props for VariEzes, Long-EZs and Defiants, for 0-200s, 0-235s, 0-320s and 0-360s. The have been making props for more than two years and their policy is to custom build the prop to suit your airplane. It is sent to you with no leading edge protection, just a coat of sealer. You then try the prop and determine the static and maximum RPM on your airplane. Send the prop back and they will fine-tune it to your desires, install a rain proof leading edge and finish the prop before sending it back to you. All of their props are done this way.

RAF has not had the opportunity to test one of these props and we recognize that we are not in a financial position to do so any more. We have, however, checked out this company to the best of our ability and have had several builder/flyers who had recommended Clark and Margaret - so we have included them in this newsletter. We solicit comments from flyers who may have tried these props or who have had any business dealings with this company. Since Great American went out of business, and in spite of Bruce Tifft's best efforts, there has been a very real problem getting quality props in a timely manner.

Anyone interested in more information contact:
Clark or Margaret Lydick
Performance Propellers
PO Box 486
Patagonia, AZ 85624
602-394-2059

AN INTERESTING OBSERVATION
"After flying my VariEze for over 400 hours with the small tires and no wheel pants, I changed to the Lamb tires, still with no wheel pants. Guess what? With small tires, it pitched slightly nose up in rain but with the larger Lamb tires, it now has a slight nose down pitch trim change in rain!
Gordon Hindle"

OH, NO!!!
Just when we'd gotten used to seeing Scooter Pie with Jerry Sloan.....now, it's a Lop Eared Rabbit on a bean bag in the back of Clayton Kau's Long!!

Burt Rutan - preflighting his latest acquisition, an Enstrom helicopter. Burt and Tonya picked it up in New Hampshire and flew it to Mojave. **PHOTO OMITTED**

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

First flight of the Pond Racer - March 22, 1991. Dick Rutan, Pilot

The first time the gear was retracted - Mike Melvill in his Long-EZ chasing Dick Rutan in the Pond Racer.

Pond Racer, seen from below.

Looking over Dick's shoulder at the Pond Racer's instrument panel. The racer weight 4000 pounds, has 2000 horsepower and approximately the same wing area as a VariEze!

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THE CANARD PUSHER No. 68 July 91
Published quarterly (Jan., April, July, Oct.) by

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Mojave, CA 93501

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Back issues $3.50

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 68.
VariViggen (2nd Edition), newsletter 18 to 68.
VariEze (1st Edition), newsletter 10 thru 68.
VariEze (2nd Edition), newsletters 16 thru 68.
Long-EZ, newsletters 24 through 68.
Solitaire, newsletters 37 through 68.
Defiant, newsletters 41 through 68.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every attempt to return your call between 3:30 pm and 5:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

OSHKOSH 1991

BURT'S FORUMS:

SATURDAY, JULY 27 - 10:00AM - TENT 3 - "TENT TALK SHOW" - OPEN AVIATION FORUM.

SUNDAY, JULY 28 - 8:30AM - EAA DESIGN COLLEGE "LIFE, THE UNIVERSE AND EVERYTHING ELSE" WITH JOHN RONCZ.

SUNDAY, JULY 28 - 10:00AM - TENT 3 - VARIVIGGEN, VARIEZE, LONG-EZ, DEFIANT, SOLITAIRE.

MONDAY, JULY 29 - 10:30AM - TENT 3 - "OUR SKY IS BIG, OUR AIRPLANES ARE FEW ...WHY DO WE STILL COLLIDE?

MONDAY, JULY 29 - 11:30AM - TENT 3 - THE POND RACER WITH DICK RUTAN AND BOB POND.

1991 IVCHC OSHKOSH ACTIVITIES

Friday, July 26: 6PM informal social dinner at the Winemaker Restaurant 414-231-1121, behind Butch's.

Saturday, July 27: 11AM Lady's Luncheon Butch's Anchor Inn. (Let's meet at Cozy Flight Line, 10:30AM. We need ladies with cars for transportation.)

Saturday, July 27: 8PM UWO Bull Session Gruenhagen Conference Center Room 112, air conditioned.

Monday, July 29: IVCHC Banquet ($14.00/person) Butch's Anchor Inn. 5:30PM (no host bar). 7:15PM (dinner) Prime rib or shrimp (pay at the door.)

Donald & Bernadette Shupe, Founders and Editor of International VariEze and Composite Hospitality Club, would like to invite EZ folks to attend IVCHC activities to be held at the 1991 EZ Oshkosh Convention.

FLY-IN

KANSAS CITY GIG, AND EZ-TYPE FLY-IN AT JOHNSON COUNTY INDUSTRIAL AIRPORT, THE WEEKEND OF JUNE 14-16, 1991

This event was a great success. Sixty-nine aircraft flew in, mostly Long-EZs, but lots of VariEzes, 4 Defiants, several Cozys, 1 VariViggen, a couple of Q2s and a Velocity.

The fly-in was a Central States Association event. Alot of people helped and it turned out to be a really fun fly-in. Lots of bull sessions, lots of organized seminars on a variety of subjects such as engine cooling, airspeed calibration, etc., etc. Very informative - lots of answers. This is what Oshkosh used to be like years ago!

A very busy schedule included a timed speed event, spot landing contest, poker run, prop balancing, etc. The award banquet was really something - great food in a wonderful facility, a slide show and lots and lots of prizes! We sure hope this will happen again next year. Wonderful hospitality, lots of fun at a really friendly airport.

NEW WORLD RECORD

Magna Liset has been at it again. Magna and fellow Australian Long-EZ flyer, Lindsay Danes, took off from Sydney, Australia and landed in Mangere, New Zealand 7 hours and 25 minutes later. This broke Don Taylor's previous world record for this crossing in his famous T-18 by some 35 minutes. Congratulations to Lindsay and Magna.

After arriving in New Zealand, these two intrepid Long-EZ pilots entered The First International Around New Zealand Air Race sponsored by Air BP. Lindsay finished the race in the money but Magna was not so lucky. Shortly after taking off from Wigram, New Zealand, the

crankshaft oil seal popped out and Magna lost all his oil. Zero oil pressure caused the engine to seize and he was faced with an emergency dead stick landing. He picked out a road and landed without incident. Even though he was heavily loaded with full fuel tanks, he did no damage to his airplane. Considering the many miles of Tasman Sea, he had so recently crossed, he was extremely fortunate that the seal chose this moment to pop out! Thanks to some members of the Royal New Zealand Air Force who pitched in, obtained another engine and helped install it, Magna was able to fly to the final banquet after the air race!

Long-EZ enthusiasts are apparently the same the world over. Wonderful effort - neat people.

NEW FAA SERVICE

AMATEUR-BUILT/ULTRA-LIGHT AIRCRAFT SAFETY DATA EXCHANGE BULLETIN BOARD SYSTEM

There is now a new service through the Federal Aviation Administration for the use of those involved with Amateur-Built and Ultra-Light Aircraft. This new service consists of a Bulletin Board for those who wish to participate in the Service Difficulty Reporting System and Safety Information of said type aircraft.

By establishing the Bulletin Board, interested users can obtain service and safety information from 1530 to 0700 central time (Monday through Friday) and 24 hours on weekends and holidays. Reports which are entered on-line into the system by members of the aviation public will be available to everyone within 12 to 24 hours.

Any PC with a modem or any terminal equipped with a modem can be used. The same equipment used for connection with DUATS can be used with this system. Normal parameters are 1200-N-8-1, but any baud rate from 1200 through 2400 is usable, and the system is entirely menu driven for ease of use. The telephone number of the system will be 1-800-426-3814, and the password is SAFETY. Also, this system is programmed to use UPPER CASE letters only.

Users of this system will be pleased to know that it is designed to protect the anonymity of the submitter. No identifying information such as registration number, serial number, city, etc., can be entered into the data base. The only identifying element will be a model name such as "VariEze". Even in the unlikely event that someone should wish to use the information in the

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data base for an enforcement action, it would be impossible.

Accident and incident reports will not be made available in this system in the traditional accident report format. A major complaint from users has been that accident reports were detrimental in many ways to the pilot or owner of an aircraft. Since the Safety Data Exchange Bulletin Board is interested in the rapid exchange of safety information, the service or safety problems contained in an accident

report will be extracted and entered into the data base in the same format as any other safety report. (No identification).

The type of information that will be in this system will be that pertaining strictly to safety and service problems in amateur-built and ultra-light aircraft. As a general guideline, anything that happens with your aircraft which may happen to another person's aircraft, should be reported. The exchange of safety information will improve safe flying for everyone. The type of information that would be helpful is as follows:

Model of aircraft (must be entered)

Engine make and model (particularly if an engine problem)

Propeller make and model (particularly if a prop problem)

Component make and model (particularly if a component problem)

Part name and part number

Location and condition of the part of problem

Remarks, in sufficient detail to help others identify the same problem

In other words, enter the information that you would like to see if you were reading the report.

It should be stressed here again that this system is just for amateur-built and ultra-light aircraft and not type certificated aircraft. There are many regulations and statutes which cover the service difficulty system as it pertains to type certificated aircraft. The reporting of safety problems for these aircraft is strongly encouraged through the traditional system.

Please be patient with any problems you may experience since the system is still in the development stage. Your questions, suggestions, or comments are welcome. The only way this system will grow and accomplish its purpose of improving the exchange of safety information is with your support.

Bob Morrow, SDR Coordinator
FAA, ACE-103
601 E. 12th Street
Kansas City, MO 64106
816-426-3580

LETTERS

"Dear RAF,

Just like to bring you up to date on my experience with my SNR problems with Loran C. I installed the IIMorrow model 604TCA. I immediately noticed SNR problems with alternator and strobes. In flight, at 2500 rpm station, M would read 25. I installed the RF170 and in flight at 2500 rpm, alternator only, M = 125, but when I added the strobes, M =

30. (255 = 100 percent and at 64 percent the warning light comes on.) I then talked to Technical Support at IIMorrow and they recommended installing a 3100uf 75vdc capacitor directly across the alternator. I then proceeded upon their advice and was successful with readings of 243 at 2500 rpm. I then also added a 4700uf 25vdc at the input power leads of the strobe power supply. At 2500 rpm, alternator and strobes, all stations have SNRs of 240 or better. These caps are electrolytic with screw top terminals and cost anywhere from $4 to $8 each.
Happy Flying,
Ray Gonzales"

Editor's Note: While we have not tried this fix, it is such a low cost way to get such excellent results we felt we should share this information with those of you who may not have the best Loran installation.

"Dear RAF;

Re: CP 67 page 11 and request for comments concerning Performance Props and the Lydicks.

I have known Clark Lydick for about 15 years and Margie since they were married - around 6 years perhaps. Clark and I flew radio controlled airplane models while he was still an active duty AF electronics engineer here in the Eglin AFB area.

You should know that Margie grew up around and helping airplane prop builder Bernie Warnke (her father) and his "Almost Constant Speed Props". Recently KitPlanes reported Bernie's props won overall in a prop competition. Margie and Clark worked with Bernie making props until about 3 years ago when they began their own business. Clark built and flew one of the most beautiful Long-EZs I've ever seen - including my own. I've been using one of his props for over a year now and can say it outperforms props I've used on my Long-EZ made by other manufacturers.

I strongly recommend that "Performance Propellers" be added to RAF recommended suppliers.

John L. Hicks"

SHOPPING

CANARD PUSHER DIGEST

Stet Elliott's Canard Pusher Digest for the Long-EZ is still available. (For a complete description of the Digest, see CP57). He has just published the 2nd edition which includes all pertinent information from CP's 24-67. The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.
Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

CP Digest for the Long-EZ.(2nd edition) $67.00
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel.
Annual Update subscription. $25.00
(4 updates)
Overseas orders add $5.00 for postage
Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

VARIEZE INDEX

Lists all plans changes from CP10 through CP64 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. This index will be updated annually.

Contact: Bill Greer
222 McLennan Dr.
Fayetteville, NY 13066
315-637-3795

RAF "GOODIES" AVAILABLE

Tie tacs-Long-EZ/VariEze (gold or silver)	6.50
Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant)	3.50
3-ship poster (17"x 22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25

LONG-EZ EXHAUST SYSTEM

All 321 stainless tubing 1-3/4" diameter with 1/4" thick stainless steel flanges. Pipes exit the cowling one above the other, two each side. Fits all Lycoming engines from 0-235 to 0-360 (no heat muff). This is the same exhaust system Dave Ronneberg designed and built and has been flying on his Long-EZ for several years. It is very similar to the 4-pipe system Mike Melvill has on his Long-EZ, N26MS, for over 4 years and 600+ trouble free hours.

Hal Hunt
6249 Longridge Ave.
Van Nuys, CA 91401
818-989-5534

Note: Hal Hunt also makes and sells a really fancy air intake with filter and carb heat valve that provides filtered carb heat. Contact Hal for details.

LONE-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
pre-cut wing &winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
P.O. Box 781
Boonville, CA 95415
707-895-2718

NOTE: NEW ADDRESS FOR ORDERING FLUSH RUDDER BELHORN SPRINGS.

John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049

FOR SALE

NARCO MK-12D with ID825 glideslope and wiring harness - perfect condition - $1800.00.

Pete Simmons 219 Pendelton Hill Rd.
North Stonington, CT 06359
203-535-2040

USED LONG-EZ PARTS FOR SALE

Lyc. 0-235 starter ring gear assy.	$ 110.00
B&C 35 amp alternator w/reg. 14V	115.00
2 Cleveland chrome brake disc. New	90.00
Throttle & mixture control cable	10.00
ATC Terra transponder - inop	7.26
Infra-red cabin heater	80.00
Hoffman 3-blade constant speed prop	3200.00
New auto fuel boost pump system	110.00
Gascolator - 1/4" pipe	10.00
Facet fuel pump - 24V	40.00
Rochester fuel pressure gauge - 12V	40.00
Brock exhaust for 0-235-320/360	60.00

All of the parts listed were used on my blue Long-EZ, N169SH, or are brand new. For more complete information contact:

Dick Rutan
Voyager Aircraft, Inc.
805-824-4608

TIFFT VARIEZE CRUISE PROP, factory refinished with Urethane leading edge. $300.00

Alan McPherson
P.O. Box 195
Stewarts Point, CA 95480
707-785-2947

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
P.O. Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

Feather Lite
P.O. Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
375872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-924-7068

Ted Hendrickson

P.O. Box 824
Concrete, WA 98237
206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received nothing but enthusiastic letters of recommendation for these props. See their ad in Sport Aviation.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

VARIEZE, LONG-EZ, DEFIANT MANDATORY GROUND

MODIFY THE LB-9 BRACKET AND INSTALL A 1/4" BIRCH PLYWOOD DOUBLER PER THE DESCRIPTION ON PAGE 8 OF THIS NEWSLETTER. ALSO, A MANDATORY WEIGHT AND BALANCE MUST BE DONE. NOTE: VORTILONS ARE MANDATORY ON THESE 3 AIRCRAFT.

VARIVIGGEN	NO PLANS CHANGES
SOLITAIRE	NO PLANS CHANGES
DEFIANT	NO PLANS CHANGES

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

OVERVOLTAGE PROTECTION

SOME THOUGHTS FROM THE AEROELECTRIC CONNECTION.

"Some kit plans and newsletters are recommending the installation of automotive alternators with built-in regulators and NO OVERVOLTAGE protection. In speaking with authors of these publications the rational offered is that they've never seen or heard of anyone having a catastrophic overvoltage event. Folks, I kid you not. The Feds will not allow me to design a certified system which lacks such protection. I too have never experienced nor talked with anyone who has experienced such a failure. However, my engineering job assignments over the years have included many failure mode effects analysis (FMEA) and mean time between failure (MTEA) studies. I can tell you that while the event is indeed rare the probability of occurrence is not zero. I can also tell you that the effects can range from trivial to life threatening.

So please, irrespective of what type of alternator/regulator combination you install in your airplane, include an automatic overvoltage protection device. In some instances of small alternators charging fairly hefty batteries, an overvoltage warning light is sufficient. See the chapter on OV protection. Any questions? Write or call."

Editor's comment: Contact Bob Nuckolls at:

The AeroElectric Connection

Medicine River Press
6936 Bainbridge
Wichita, Kansas 67226
316-685-8617

if you have any problems. Bob designs electronic controls for a living and is an expert in the field.

This editor has seen what happens when a voltage regulator stops controlling the alternator's charge to the battery. Bob's comment about "life threatening" is not an exaggeration. The results are spectacular. Thank heavens my example occurred on the ground! The best way to take care of this problem in my opinion is to install one of Bill Bainbridge's high tech voltage regulators.

(designed by Bob Nuckolls). These have built-in instantaneous overvoltage protection. Contact Bill at: B & C Specialties
316-283-8662

ACCIDENTS AND INCIDENTS

FAILED MAIN LANDING GEAR DUE TO HOT BRAKES.

This is a subject that has been addressed before but we continue to hear from builders who are having problems in this area. We are revisiting this problem because recently we have received two reports from builder/flyers who have had this problem on airplanes with 300 to 500 flying hours on them.. These were not new airplanes. Originally the problems were associated with new airplanes doing taxi tests with wheel pants on. All the braking used while learning to drive a different airplane like an EZ, simply overheats the brake discs. This heat radiates into the strut and literally boils the epoxy out of the strut locally opposite the brake disc. Well, we are now finding out that this scenario also holds true on older airplanes. At one time, we had figured that the strut, over a period of time, gets postcured by repeated heat cycles due to braking and, thus, the heat distortion temperature goes up and makes the strut less prone to this type of problem. We still believe this to be true but only to a point. If you, for example, go to check out a new EZ pilot and have him or her conduct high speed taxi runs and stops on a runway, be certain that you will have this failure occur if you do not remove the wheel pants. There simply is not enough cooling available with wheel pants on to allow for this kind of operation. Normal take-off, go somewhere, then land operations do not put the thermal load into the discs that high speed taxi and runway flight tests do.

For additional protection from this radiating heat damage, install a 1/8" thick aluminum plate between the axle flange and the gear strut such that is extends up an inch or two above the brake disc and is somewhat wider than the strut. This will act as a heat reflector to reflect radiating heat from a red hot brake disc. You will still need to wrap the strut with fiberfrax and aluminum foil tape to insulate the glass strut.

A Long-EZ was involved in an accident in Utah recently that resulted in serious back injury to the pilot who was flying solo. This pilot was a relatively new private pilot with only a few hours in type. While attempting to cut a roll of toilet paper, this pilot managed to get the airplane too slow, with too much angle of attack and the airplane apparently entered a "deep stall" condition. The pilot did not recover from the deep stall condition, and the aircraft descended in a flat attitude (75 to 85 degrees AOA), striking the ground slightly nose high with very little forward speed. The pilot suffered serious back injuries and the entire aircraft bottom and landing gear were heavily damaged.

There were a number of eye witnesses to this accident and our investigation leads us to suspect that the aircraft was being flown with a CG that was well aft of the published aft limit. This aircraft also was not equipped with vortilons.

If you are currently flying a VariEze, a Long-EZ or a Defiant and you are not positive of your aircraft's center of gravity, ground your aircraft until you have conducted an accurate weight and balance using calibrated balance beam scales or calibrated load cells. Do not bet your life on bathroom scales. You must not fly your aircraft unless you know exactly where your CG is. Do not fly a Long-EZ or VariEze without vortilons. In addition, due to the variance in aircraft shapes, and indeed, airfoils shapes possible in a homebuilt aircraft, we would strongly recommend that you conduct a stall test at least 10,000 feet above the ground while wearing a parachute. This will clear the stall envelope on your particular aircraft which, as we have said, may not be identical to the RAF prototype or to anyone else's aircraft. If you see any sign of an unusual or uncommanded pitch up or any hesitance in nose down control power when at full aft stick, go to full power and full forward stick immediately and recover! If your aircraft hangs in a high sink condition, rock it out with ailerons and rudder, using maximum available engine power. Ballast your aircraft to a more forward CG and retest. If you do not want to take the risk of doing this stall test program, do, at least, limit your flying to mid or forward CG.

This particular accident and injury pointed again to the advisability to modify the LB-9 plywood

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bracket that supports the landing brake actuating weldment. This was called out as a mandatory change in July 1981, CP29, page 7. We have noted that few builders have made this modification. We would like to reiterate this requirement and add an additional change as shown in the sketch below. Cut away the entire lower portion of the LB-9 bracket as shown and remove the lower piece and discard it. Cut out a piece of 1/4" thick birch plywood (firewall material) approximately 8" wide and 9" long. Bevel the edges and flox it onto the forward face of the front seat bulkhead, centering it over the LB-9 bracket. Lay up four (4) plies of glass BID over the entire piece of plywood lapping onto the front seat bulkhead a minimum of 2" all around. **SKETCH OMITTED**

This change is mandatory and should be completed before next flight. Also, strongly consider the use of the energy-absorbing Tempa-foam cushions for both seats. Now, this may seem ridiculous to modify your airplane in order to protect yourself from a full-blown deep stall crash that on a normal airplane would be fatal. However, we continue to be surprised at the protection provided by the EZs composite structure and we always take the conservative approach to increase safety as much as possible.

THE FOLLOWING IS AN ANALYSIS OF THE UTAH ACCIDENT

The Utah accident involved a deep stall, flat descent (angle of attack of about 80 degrees). The fact that the pilot survived and that a slower-than-expected sink rate occurred (confirmed by video tape evidence of the last 2.3 seconds of descent) presents somewhat of a dilemma. We are baffled as to why this can occur. A similar phenomena has been experienced during several deep stall accidents with the Velocity aircraft. All were survivable and one went into water with the pilot experiencing no injury at all! (See article in July '91 Sport Aviation.)

The Utah Long-EZ had a wing-loading of about 12.2 lbs./sq. ft. and, considering all its area, including the wings, strakes, cowl and fuselage, a "flat-plat loading" of about 9.2 lbs./sq. ft. (1150 lbs. divided by 125 sq. ft.). A basic calculation of the predicted rate-of-sink in a flat descent would use a flat-plate drag coefficient of about 1.2 and would predict a sink of about 4820 ft. per minute or 80 ft./sec. This would definitely not be survivable.

Using two different methods, we have calculated that the Utah Long-EZ probably had a drag of about 2.8 times that predicted by simple flat-plat theory, i.e. a co-efficient of about 3.3. This results in an energy at impact of only about 1/3 that which would result from the "calculated prediction" sink of 4820 ft./min. Here's the two methods:

1) Analysis of the video tape shows a sink rate of about 48 ft./sec. (2900 ft./min.). This required measuring the size of the airplane image and may be off as much as 30 percent. The post-crash video data show the rate of drift of dust from impact. Comparing this rate of drift of dust (wind was about 20 knots) to the rate of sink of the airplane (on video) confirms the approximate 48 ft./sec. estimate.

2) Assuming a 48 ft./sec. descent, the main landing gear would absorb 18 ft./sec. before the fuselage strikes the dirt - this is a relatively accurate calculation knowing the gear's stiffness and strength. Absorbing the remaining 30 ft./sec. over a total deflection of approximately 6.7" (cushion, plus fuselage, plus dirt), results in an average deceleration of about 25 G with a peak deceleration of about 40 G. Considering the

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support and attitude of the pilots back, this is consistent with the injuries he sustained. An 80 ft/sec descent would result in a fatal 150+ G impact of the spine.

Both these methods are very rough but (along with the deep stall accident experience with the velocity) they tell us that an unusual phenomena is occurring. It is likely that a large, trapped vortex forms above the aircraft. It's relatively easy to see how this could increase the drag by 25 to 50 percent, but it makes no logical sense that it could increase drag by a factor of 2.8 - this would require the airplane to decelerate a column of air that is more than 3 times the size of the airplane! What is even more baffling is the report (not confirmed by us) that the Velocity aircraft sinks at less than 1500 ft/min (15 knots!). If that were true, it would have to have a "flat-plate" drag coefficient of about 12! ! (A totally illogical result). We suspect that the Velocity and Long-EZ have similar drag coefficients and that the cushion of water landing provided the difference in pilot injury.

The Utah pilot had one thing going for him, he was sitting on seat cushions fabricated from Tempa-Foam an excellent impact absorber.

CONCLUSION: What can we learn from this accident? First of all, don't just jump into someone's homebuilt airplane and go flying. Insist on seeing a current weight and balance and discuss any possible "quirks" the airplane may have with the owner.

Do not let peer pressure tempt you to fly beyond your experience or capability. Cutting a roll of toilet paper requires absolute knowledge of your aircraft without referring to the instruments. You will be looking over your shoulder for the toilet paper ribbon for most of the flight which requires some aerobatic experience at least. This is not a sport for neophytes. If a VariEze or Long-EZ is not equipped with Vortilons on the leading edges of the wings do not fly it!

WHAT'S NEW?

If you haven't been to Mojave's airport lately, you've missed what may be the world's largest commuter hub. Since a number of airlines have filed for protection under Chapter 11, what was once desert and greasewood is now covered with many dozens of airliners. There are DC-9s, 727s, l-1011s, 767s (brand new!), 737s, a 747-400!, BA-146s, 707s, DC-8s, etc., etc. Has to be seen to be believed.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Is this a happy man!?! John Hicks, Mary Esther, FL

Frank Rowton, Albuquerque, NM, has a way(s) to go.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Nick Saliba and his wife, Lillian, with their recently completed Long-EZ. Nick is 78 years young and his first ride in a Long-EZ was when he made his first test flight - Good show, Nick!

Martin Fagot's neat little VariEze - Martin's from Bay St. Louis, MS

Chris Weiser's Long-EZ, N202EZ. Dick Rutan did the first flight on Valentine's Day 1991. Chris is an engineer at Scaled who took 9 years to build - but says it was worth the effort.

Bill Helland's clever turn over/roll around fixture lets him handle his Defiant project with no help at all!

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THE CANARD PUSHER No. 69 Oct 91
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Building 13 - Airport
Mojave, CA 93501
805-824-2645

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Back issues	$ 3.50

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 69.
VariViggen (2nd Edition), newsletter 18 to 69.
VariEze (1st Edition), newsletters 10 thru 69.
VariEze (2nd Edition), newsletters 16 thru 69.
Long-EZ, newsletters 24 through 69.
Solitaire, newsletters 37 through 69.
Defiant, newsletters 41 through 69.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00 When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every attempt to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

This newsletter contains mandatory changes/corrections required for VariEzes, Long-Ezs, Defiants, Solitaires and VariViggens. These required changes are references only and you will need your reference library of CPs to get the full details.

OSHKOSH 1991

Once again a Long-Ez wins Grand Champion, Custom built. Congratulations to Bob and Ginny Greider of Escondido, CA. Jack Cox wrote a great article with excellent photos in Sport Aviation, October, 1991.

At Oshkosh this year, Burt announced that RAF would be conducting a full investigation of the deep stall phenomenon as a follow-up to Danny Meyer's testing of his Velocity as reported in Sport Aviation. In order to conduct this testing, we need a Long-EZ. It does not need to

be complete with engine or instruments. Please call or write if you have one to donate to the cause.

NEW SERIAL NUMBERS

At last, we are able to tell you that new serial numbers have been assigned. If both the name and number on your mail label have an asterisk by them, then that number is your new serial number. If you receive CP information from someone else's subscription but you are the original purchaser of RAF plans and responded to the survey, please contact our office and we will give you the number assigned to you. If you responded to the survey and believe you should have received a new number but didn't, please call RAF.

ATTENTION BUILDERS

If you are currently building a Long-EZ, you are missing a bet if you do not subscribe to the Central States newsletter. Editor Terry Schubert is doing a tremendous job of writing and publishing really helpful builder hints.
Contact: Terry Schubert
9283 Lindbergh Blvd.
Olmsted Falls, OH
44138-2407

If you are currently building a Defiant, you should subscribe to the Defiant Flyer. Defiant builder/flyer John P. Steichen is the editor of this excellent newsletter which is full of information on building and flying the Defiant.
Contact: John Steichen
960 86th Street
Downers Grove, IL 60516

CAUTION

We were shocked to see an example of a prefabricated canard for a Cozy/Long-EZ at Oshkosh. The workmanship on this canard was the worst we have ever seen. This canard was not built in accordance with the plans, it was grossly overweight and,as poorly as it was built, had it been flown on an airplane, it might have caused a life-threatening accident. If you have purchased a prefabricated canard from Fitzgeratd Composites, Inc. of Bristol, WI, we would strongly recommend that you not fly it. At the very least, weigh it. If it weighs more than 19 lbs. (canard only), cut 3" off one end, outboard of the outbaord elevator hinge, and carefully examine the structure. If it is not built precisely per the plans, discard it and build one yourself. If a canard fails in flight, there is no possibility of survival.

SHOPPING

CANARD PUSHER DIGEST, 2ND EDITION

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now in its 2nd edition. (For a complete description of the Digest, see CP57).

Includes all builder related information from CPs 24-68. The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current . The updates are compatible with either Digest edition.

CP Digest for the Long-EZ (2nd Edition) $75.00.
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel
Annual Update Subscription $25.00.
(4 updates)
Overseas orders add $5.00 for airmail.
Contact: Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

VARIEZE INDEX

Lists all plans changes from CP10 through CP64 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. This index will be updated annually.
Contact: Bill Greer
222 McLennan Dr.
Fayetteville, NY 13066
315-637-3795

RAF "GOODIES" AVAILABLE

Tie tacs-Long-EZ/VariEze (gold or silver)	6.50
Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
**Night photo by Jim Sugar - new this year at Oshkosh	5.00

LONG-EZ EXHAUST SYSTEM

All 321 stainless tubing 1-3/4" diameter with 1/4" thick stainless steel flanges. Pipes exit the cowling one above the other, two each

side. Fits all Lycoming engines from 0-235 to 0-360 (no heat muff). This is the same exhaust system Dave Ronneberg designed and built and has been flying

---

on his Long-EZ for several years. It is similar to the 4-pipe system Mike Melvill has on his Long-EZ, N26MS, for over 4 years and 600+ trouble-free hours.

Contact: Hal Hunt
6249 Longridge Ave
Van Nuys, CA 91401
818-989-5534

Note: Hal Hunt also makes and sells a neat air intake with filter and carb heat valve that provides filtered carb heat. Contact Hal for details.

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

NOTE: NEW ADDRESS FOR ORDERING FLUSH RUDDER BELHORN SPRINGS.
John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049

NACA FRESH AIR INLET VENT DOORS.

Gene Zabler's neat little vent door is still available for $7.50 pp. Gene tells us that after 8 years in service some of these little doors are wearing out. If yours is, send an SASE and $2.00 to Gene and he will ship you a new rubber insert. Gene also manufactures and sells a light weight nose wheel fender (protects your prop from gravel damage) for $45.00 pp.

Contact: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
414-886-5315

THE AERO ELECTRIC CONNECTION

is a book published for people who desire a working understanding of aircraft electrical systems and components. It is produced as a periodical publication of chapters on specific topics. For example, issue #1 covers d.c. electrical fundamentals, batteries, engine driven power sources, voltage regulators and grounding. Issue #2 continues overvoltage protection, low voltage warning systems, wiring, wire terminations and circuit protection. This first of a series of simplified wiring diagrams for composite airplane with high capacity alternators was published with issue #2. Issue #3 added diagrams for airplanes with and without starters plus versions using small permanent magnet, dynamo type alternators. A series of do-it-yourself avionics articles and kits are in planning. An entire issue will be devoted to providing a customizable book form wiring diagram for your airplane.

Contact: The AeroElectric Connection
Medicine River Press
6936 Bainbridge Rd.
Wichita, KS 67226-1008
316-685-8617

FOR SALE

Great American Prop for 125hp 0-235-L2C Lycoming. On a Long-EZ - like new, 62x64.

Contact: John VanCleve or
Ralph VanCleve
501-835-3848

New, Improved Fuel Sight Gauges. Use with auto fuel or avgas. Clear bubble with white background. Easy retrofit for VariEzes and Long-Ezs. $30.00 per set.

Contact: Vance Atkinson
3604 Willomet Ct.
Bedford, TS 76021-2431
817-354-8064

Original VariEze Main Gear Strut (new).

Contact: Lee Deshler
6822 Windover Way
Titusville, FL 32780
407-267-1129

Cleveland 500x5 magnesium wheel/aluminum brake kit, part #199-102, never used - $200.00.

Contact: Bill Ginn
406 Daffodil
Lake Jackson, TX 77566
409-297-0863

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00

Contact: Larry Lombard or
Mike Dilley at
Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 pp. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.

Contact: Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
375872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received nothing but enthusiastic letters of recommendation for these props. See their ad in Sport Aviation.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

THIS ISSUE LISTS MANDATORY GROUND CHANGES THAT HAVE APPEARED IN THE NEWSLETTERS OVER THE YEARS FOR ALL RUTAN DESIGNED AIRCRAFT.

THERE ARE NO NEW CHANGES TO ANY AIRCRAFT IN THIS CP.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

WANTED

For my Long-EZ project:

1) Rusty Foster's Space Saver Panel
2) Wheel pants for 3.5x5 tires
3) Avionics (used)
   *Nav/Comm/Glide slope
   *VOR/Loc/GS head
   *Loran with database
   *Transponder/Encoder
   *Marker
   *ICS and headsets
4) Engine and Flight instruments
5) Lyc 0-320, low time with good logs

Contact: C. E. Chisolm
2700 Vista Grande NW #71
Albuquerque, NM 87120
505-764-5342 (W)
505-839-0525 (H)

SCALED COMPOSITES NEEDS A MANUFACTURING ENGINEER. SPECIFICALLY, A PERSON WITH COMPOSITE TOOLING DESIGN EXPERIENCE. NEED NOT BE A DEGREED ENGINEER. PRACTICAL EXPERIENCE IS A PRE-REQUISITE.

CONTACT: DAN COONEY
SCALED COMPOSITES, INC.
HANGAR 78 - AIRPORT
MOJAVE, CA 93501
805-824-4541

THE FOLLOWING IS A LIST OF MANDATORY GROUND CHANGES FOR RUTAN DESIGNED AIRCRAFT. PLEASE NOTE THAT THERE ARE ALSO MANDATORY CHANGES WITHIN A GIVEN NUMBER OF HOURS THAT ARE NOT INCLUDED AS WELL AS MANY HUNDREDS OF SIGNIFICANT CHANGES THAT AFFECT THE SAFETY AND FLIGHT QUALITIES OF THE

AIRCRAFT. WE HIGHLY RECOMMEND THAT YOU REVIEW ALL PLANS CHANGES TO INSURE THE SAFEST FLYING PLANE POSSIBLE.

SOLITAIRE MANDATORY GROUND PLANS CHANGES

CP 57 - 7
Subject Warning placard

DEFIANT MANDATORY GROUND PLANS CHANGES

CP 49 - 6
Subject Rudder pedal/brake assembly outboard mount.
Subject Steering pivot rigging and "trail" of axle relative to pivot axis.
Subject Roll and yaw control systems.

CP 51 - 7
Subject Canard strengthening by adding plies of glass.

CP 53 - 4
Subject Nose gear retraction link rod end bearings.

CP 57 - 7
Subject Fuel pump replacement.

Subject Warning placard.

VARIVIGGEN MANDATORY GROUND PLANS CHANGES

CP 4 - 4
Subject 3/32 cable.
Subject Stiffen SA5.

CP 6 - 9
Subject main gear emergency extension system.

CP 9 - 7
Subject Fuel valve location.

CP 12 -11
Subject Reflex for first flight.

CP 17 - 6
Subject Canopy safety catch.

CP 57 - 7
Subject Warning placard.

LONG-EZ MANDATORY GROUND PLANS CHANGES

LONG-EZ MANDATORY GROUND PLANS CHANGES

CHAPTER 9, MAIN GEAR/LANDING BRAKE

CP30-8
LPC #75
Ensure a minimum of 1/16" clearance between gear strut and brake caliper.

CP48-5
LPC #127
A mandatory inspection of your nylon brake lines is required before next flight. If these brake lines have been directly exposed to radiating heat from the brake discs, or to sunlight (UV) they must be replaced.

CHAPTER 11, ELEVATORS

CP57-8
MAN GRD
Inspect or certify that elevators meet specifications in regard to weight, stiffness and shape.

CP66-9
MAN INSPECTION
Inspect elevator torque tubes for corrosion.

CHAPTER 13, NOSE AND NOSE GEAR

CP30-9
LPC #86, MAN/10HRS
Reinforcement of top tab welded to the rudder pedal.

CHAPTER 14, CENTERSECTION SPAR

CP28-9
LPC #56, MAN GRD
Long-EZ spar cap thickness

CHAPTER 16, Control System

CP49-6
LPC #131 MAN-GRD
Substitution of 4130 steel or stainless for aluminum roll and yaw control components in cowling area. Use Ocean Intumescent fireproof coating.

CHAPTER 19, WINGS, AILERONS/WING ATTACH

CP28-9
LPC #56, MAN GRD
Long-EZ spar cap thickness

CP30-9
LPC #81
Rodend attachment to CS 132L belhorn.

CP47-7

LPC #126, MAN
Vortilons on each main wing are mandatory.

CP58-10
MAN-GRD
Replace aileron belhorns within next 25 hours. Rebalance vibrating ailerons.

CHAPTER 21, STRAKES - FUEL/BAGGAGE

CP24-6
LCP #4, DES, Chap 7 & 21
See Safe-T-Poxy recommendation below for fuel areas.
The interior fuel tank layup and fuselage side layup should be done using only Safe-T-Poxy.

CP65-7
MAN/GND
Mandatory inspection of polyurethane fuel and vent lines.
Mandatory inspection of throttle/mixture springs.

LONG-EZ SECTION VI, LANDING BRAKE PLANS

CP29-7
LCP #65, MAN GRD
Modification of LB9 to allow it to collapse in a crash without piercing the seat bulkhead.

CP68-6
MAN GRD
Modify the LB-9 bracket and install a plywood doubler on forward face of front seat bulkhead.

SECTION IIL, LYCOMING O-235 ENGINE INSTALLATION

CP24-6
LCP #1, MAN GRD
Safetying Bendix fuel pump bottom cap.

CP31-5
LCP #94, MAN GRD, 25 HOUR
Replacement of aluminum fittings with steel.

CP49-6
LCP #131, MAN GRD
Inspection of all fuel system plumbing and components for approved fireproof components. Use fireproof sleeves on all hose components.

CP51-7
LCP #132, MAN-GRD
Inspection of engine mixture control system.

CP62-7
MAN GRD
Inspect exhaust system every time cowl is removed or every 50 hours.

CP65-7

MAN/GRD
Mandatory inspection of polyurethane fuel and vent lines.
Mandatory inspection within next 10 hours of throttle/mixture springs.

Optional Special Performance Canard Plans

CP57-8
MAN GRD
Inspect or certify that elevators meet specifications in regard to weight, stiffness and shape.

CP66-9
MAN INSPECTION
Inspect elevator torque tubes for corrosion.

Long-EZ Owner's Manual

CP26-6
LPC #41, MAN GRD
Added pressure range for 6 ply tires.

CP36-6
LPC #115, MAN-GRD
Long-EZ may spin when at or aft of aft CG limit.

CP37-4
LPC #116, MAN GRD
Aft CG limit moved from 104 to 103.
(This plans change was made mandatory in CP 39.)

CP49-6
LPC #130, MAN GRD
Clear idling engine every 15 seconds or so on approach. Always fly final with speed brake extended.

CP57-7
MAN GRD
Placard aircraft with notice that amateur built aircraft are more likely to have an accident.

CP63-10
MAN GRD
Always fuel aircraft in level attitude when needing full fuel tanks.

RUTAN AIRCRAFT WOULD LIKE TO THANK STET ELLIOTT AND BILL GREER FOR THEIR HELP IN PUTTING TOGETHER THIS NEWSLETTER. THEIR DIGESTS ARE INVALUABLE.

How's this for a model?!! 4.24 meter wingspan!! **PHOTO OF SOLITAIRE MODEL OMITTED**

CARTOON OMITTED

The following pages contain :

VARIEZE MANDATORY GROUND PLANS CHANGES

CP69, Page 7

Chapter Section IV, Owner's Manual
CP Issue 15-7
Subject fuel filter
MAN/GRD Replace or inspect fuel filter at 25 hour intervals.

Chapter Section II, Engine Installation & Systems
CP Issue 16-9
Subject exhaust system
MAN/GRD Install safety cables on VE exhaust systems. Article discusses various exhaust systems & problems. See also CP18.

Chapter 17
CP Issue 16-5
Subject strut
MAN/25HR Strut beef up & mod to NG15.

Chapter 22
CP Issue 17-6
Subject safety catch
MAN/GND Plans for secondary canopy catch. Prevents open canopy accidents. DO NOT OMIT THIS!!

Chapter Section II, Engine Installation & Systems
CP Issue 17-4
Subject fuel valve
MAN/GND Replace fuel valve if stiff. (If the valve is stiff, not you.) If valve is selected between wings and fuselage position, the fuselage tank will drain into the wings.

Chapter 22
CP Issue 18-8
Subject fuselage tank
Fuselage fuel tank requires changes in canopy construction.

Chapter Section IV, Owner's Manual
CP Issue 15-3
Subject performance
Flight test performance data from N4EZ. Fuel flow, speed, etc. Paste these in the owners manual.

Chapter 18
CP Issue 16-6
Subject brake lines
MAN/25HR Install inserts in Nylaflow brake lines. (See also CP27, pg5)

Chapter 4
CP Issue 16-4
Subject surface smoothness

MAN/GND The top surface of the canard must be smooth within .006 in. How to check, flight tests to confirm.

Chapter 5
CP Issue 17-5
Subject wide chord elevators
MAN/GND Plans for wide elevators for VE. Optional for those already flying & used to narrow elevators. Templates to check elevator shape.

Chapter 16
CP Issue 18-9
Subject fuel valve
Fuel valve moved. Gascolator added.

Chapter 21
CP Issue 18-8
Subject fuselage tank
How to make & install fuselage fuel tank.

Chapter Section II, Engine Installation & Systems
CP Issue 18-3,7
Subject fuel system
MAN-25HRS Revised fuel system adds gascolator and fire resistant fuel lines. Fuel valve relocated. Plans for fuselage tank.

Chapter 17
CP Issue 19-3,5,7
Subject worm drive
MAN/GND Worm drive for nose gear prevents gear collapse. Plans in this CP.

Chapter 19
CP Issue 20-4
Subject rod ends
MAN/GND Replace HM-3 rod ends in pitch system with 1/4".

Chapter "Other"
CP Issue 21-5
Subject first flight
Many good recommendations on pilot technique for VE.

Chapter Section II, Engine Installation & Systems
CP Issue 21-5
Subject fuel system
System shown in IIC, pg 36 is obsolete.

Chapter Section IV, Owner's Manual
CP Issue 21-5
Subject nose gear
Add note to grease gears in nose gear.

Chapter 5
CP Issue 19-4
Subject balance

MAN/GND Overweight or out of balance elevators must be corrected or rebuilt to prevent flutter. 1/2 of any weight added must go on outboard weight.

Chapter 6
CP Issue 19-2
Subject cuffs
MAN-25HR Cuffs added to rear wing to prevent departure at low speed. (Replaced by vortilons.) Good discussion of aft wing stall & departures. AFT CG LIMITED UNTIL CUFFS ARE INSTALLED.

Chapter 18
CP Issue 20-3
Subject strut
MAN How to prevent and repair compression damage to strut. Mandatory 3 ply mod for new construction, 7 ply fix for damaged struts.

Chapter Section IV, Owner's Manual
CP Issue 21-5
Subject first flight
Many good recommendations on pilot technique for VE.

Chapter Section IV, Owner's Manual
CP Issue 21-5
Subject first flight
Add note to clean out all fuel system screens and carb float bowl before first flight.

Chapter "Other"
CP Issue 21-4
Subject plans changes
Cumulative list of plans changes up to July 1979.

Chapter 1
CP Issue 21-4
Subject correction
Cumulative list of plans changes up to July 1979.

Chapter Section IV, Owner's Manual
CP Issue 22-8
Subject slips
MAN/GND Pg. 19, add note to avoid aggravated slips at low altitude. Can result in winglet stall. How to recover.

CP Issue 22-8,7
Subject fuel contamination
MAN/GND change to addition made in CP21. Clean all screens and needle valve before first flight.

Chapter Section IV, Owner's Manual
CP Issue 22-8,4
Subject hoses
MAN/GND Under power plant add "inspect induction hoses for correct safety of wire and cord."

Chapter Section II, Engine Installation & Systems
CP Issue 23-7
Subject Continental engines
MAN/GND Continental engines without starter must install bearing retainer to prevent spontaneous conversion of engine into boat anghor. CP gives plans for retainer.

Chapter Section IV, Owner's Manual
CP Issue 24-6
Subject first flight
Test pilot should have 10 hours VE time.

Chapter 15
CP Issue 22-11
Subject seat belts
MAN/GND Eon E 8000 seat belt are unsafe, they can come open unexpectedly. Do not use.

Chapter Maintenance & Inspections
CP Issue 22-8
Subject screens
MAN/GND Clean all screens before first flight, then every 25 hours for first 100 hours, then every 50 hours.

Chapter Maintenance & Inspections
CP Issue 22-8,4
Subject hoses
MAN/GND Inspect induction hoses for correct safety of wire and cord.

Chapter 19
CP Issue 22-8,7
Subject rudder travel
MAN/GND Reduce rudder travel from 3.5" to 2".

Chapter 19
CP Issue 23-6,7
Subject rudder travel
MAN/GND Reduce rudder travel from 3.5" to 2". Clarification of earlier change. Keep brakes in top shape!

Chapter Section IV, Owner's Manual
CP Issue 24-6
Subject pilot checkout
Additions to pilot checkout criteria.

Chapter 3
CP Issue 24-4
Subject weight
Too many airplanes are coming out too heavy. Delay installation of extras. Other hints for weight control & mods.

Chapter Maintenance & Inspections
CP Issue 26-6

Subject wing fitting
MAN 100 HR Remove and inspect wing attach bolts for corrosion annually or each 100 hours. Spray LPS #3 on bolts and cones.

Chapter Section IV, Owner's Manual
CP Issue 28-9
Subject checklist
After "fuel caps on" add "and locked - screws aligned to locked orientation".

Chapter Section IV, Owner's Manual
CP Issue 29-7
Subject Checklist
After "canopy locked" add "visually confirm proper canopy latch engagement and proper safety catch engagement".

Chapter Landing Brake
CP Issue 29-7
Subject LB29
MAN/GND See LPC #65 for redesign of LB29. Applies to VE also.

Chapter 17
CP Issue 30-5
Subject rudder pedals
Modify rudder pedal to prevent tab breaking off. Brock has parts.

Chapter Section IV, Owner's Manual
CP Issue 26-6
Subject tires
MAN/GND Sec IV pg 33 After 55 to 65 psi add "75 to 80 for 6 ply tires".

Chapter 19
CP Issue 27-5
Subject push rods
Drill an inspection hole in all push rod tubes to be sure enough rod end threads remain in the bushing.

Chapter Section II, Engine Installation & Systems
CP Issue 28-8
Subject exhaust gaskets
Use blow proof gaskets. Mandatory if using cabin heat.

Chapter Section IV, Owner's Manual
CP Issue 29-7
Subject owners manual
Add CAUTION to check prop bolts torque 180 in lbs when moving from wet climate to dry climate.

Chapter 18
CP Issue 30-8
Subject brake caliper
There must be 1/16" clearance between caliper and strut. (see LPC #75)

Chapter Section II, Engine Installation & Systems
CP Issue 31-8
Subject installation
MAN/GRD Upgrade fuel & oil hoses to standard shown in CP.

Chapter 21
CP Issue 31-5
Subject fuel caps
Install safety chain on fuel cap to prevent loss.

Chapter Section IV, Owner's Manual
CP Issue 31-5
Subject owners manual
Under engine failure add caution to use power during descents when carb ice is likely.

Chapter Section IV, Owner's Manual
CP Issue 33-4
Subject ditching procedure
Ditching procedure for VE explained. Add to owners manual.

Chapter 6
CP Issue 34-6
Subject hinges
MAN Aileron hinge pins must be saftied. Shows proper method.

Chapter 17
CP Issue 35-10
Subject sealing nose
How to seal up nose so cabin heat will work. Battery must be manifolded type and vented overboard.

Chapter Landing Brake
CP Issue 43-4
Subject LB19
MAN/25 HRS Modify LB 19 plywood insert, or add glass reinforcement as shown.

Chapter Maintenance & Inspections
CP Issue 31-5
Subject main gear
At annual or 100 hour inspection jack airplane and check gear for excess motion.

Chapter Section II, Engine Installation & Systems
CP Issue 32-5
Subject magnetos
"Left" mag should be referred to by engine manufacturer, even though it is on the right side of a VE.

Chapter 7
CP Issue 34-6
Subject hinges
MAN Rudder hinge pins must be saftied. Shows proper method.

Chapter Section III, Electrical Systems
CP Issue 35-10
Subject cabin heat

Electrical cabin heat system, takes 20 amps. How to seal up nose. Battery must be manifolded type vented overboard.

Chapter Section III, Electrical Systems
CP Issue 35-10
Subject battery
Suggested manifold vented battery.

Chapter Maintenance & Inspections
CP Issue 62-7
Subject exhaust system
MAN/GND Inspect exhaust system for cracks.

Chapter Maintenance & Inspections
CP Issue 61-10
Subject wing fitting
MAN/GND Inspect AN-4 bolts & taper plugs in wing fittings. Caused fatal accident.

Chapter 6
CP Issue 61-10
Subject attach fitting
MAN/GND Check taper pins & AN-4 bolts for proper fit. Caused fatal accident.

Chapter 19
CP Issue 58-7
Subject ailerons
MAN/GND Check bellhorns, replace within 25 hrs. Rebalance ailerons if vibrating.

Chapter 5
CP Issue 57-8
Subject balance
MAN/GND Inspect for proper construction. New balance requirements & discussion of flutter. Reuse of elevator tube if building new elevator.

Chapter 6
CP Issue 55-5
Subject attach fitting
MAN/GRD Check wing attach fittings for corrosion. Method for replacing fittings.

Chapter Maintenance & Inspections
CP Issue 53-7
Subject airspeed indicator
Check accuracy of airspeed indicator. CP shows manometer for doing this.

Chapter Section II, Engine Installation & Systems
CP Issue 61-7
Subject controls
MAN/GND Wrong outer cable attachments caused engine failure.

Chapter 8
CP Issue 61-10
Subject attach fitting
MAN/GND Check taper pins & AN-4 bolts for proper fit. Caused fatal accident.

Chapter Maintenance & Inspections
CP Issue 57-7
Subject placards
MAN/GND Check for proper placards in cockpit. Install "You may die if you fly this airplane" placard.

Chapter Maintenance & Inspections
CP Issue 55-5
Subject wing fitting
MAN/GND Check wing attach fittings for corrosion.

Chapter 8
CP Issue 55-5
Subject attach fitting
MAN/GND Check wing attach fittings for corrosion. Method for replacing fittings.

Chapter 8
CP Issue 53-7
Subject attach fitting
MAN/GND Corrosion found on fittings. Alodine treat all new fittings. No not anodize.

Chapter Maintenance & Inspections
CP Issue 53-7
Subject wing fitting
MAN/GRD Check wing attach fittings for corrosion. Alodine new fittings. Do not anodize.

Chapter Maintenance & Inspections
CP Issue 51-6
Subject mixture control
MAN/GND Problems with mixture control have caused 2 forced landings. Check for proper installation & operation.

Chapter 8
CP Issue 50-4
Subject attach fitting
MAN/GND Use stud finder to verify all screws are installed. Missing screws caused fatal accident.

Chapter 16
CP Issue 49-5
Subject fireproofing
MAN/GND Replace aluminum control system parts with steel. Use Ocean #1644 to fireproof CS spar. See pg 3 for source of Ocean #1644.

Chapter Section II, Engine Installation & Systems
CP Issue 49-5
Subject fireproofing
MAN/GND Replace aluminum control system parts with steel. Use Ocean #1644 to fireproof CS spar. See pg 3 for source of Ocean #1644.

Chapter Maintenance & Inspections
CP Issue 48-5
Subject brake lines
MAN/GND Inspect brake lines for damage from disc heat or sunlight.

Chapter Section II, Engine Installation & Systems
CP Issue 51-6
Subject controls
MAN/GND Problems with mixture control have caused 2 forced landings. Check for proper installation & operation.

Chapter 6
CP Issue 50-4
Subject attach fitting
MAN/GND Use stud finder to verify all screws are installed. Missing screws caused fatal accident.

Chapter Section IV, Owner's Manual
CP Issue 50-5
Subject checklist
MAN/GND Should read "Check fuel caps on and positively locked." Check cap O-rings before each flight. Never fly without header tank full. Other cautions related to engine & fuel.

Chapter 19
CP Issue 49-5
Subject fireproofing
MAN/GND Replace aluminum control system parts with steel. Use Ocean #1644 to fireproof CS spar. See pg 3 for source of Ocean #1644.

Chapter 21
CP Issue 48-5
Subject tank vents
MAN/GND Separate tank vents recommended in CP47 pg 6 are a mandatory plans change.

Chapter Safety & Accident Information
CP Issue 44-8
Subject hot dogging
Low flying causes or contributes to many LE accidents. Don't!

Chapter Maintenance & Inspections
CP Issue 44-8
Subject cracks
MAN/GND Cracks have been found in the bottom skin of fuel tank - center section area. They were probably caused by sanding away structure at the edge of CS spar. Includes info on how to repair.

Chapter 3
CP Issue 12-8
Subject quality control
The most important inspection is just after layup is done, many problems can still be corrected. Get someone else to check it. How to do a post layup inspection.

Chapter 2
CP Issue 12-18
Subject aileron plans
MAN/GND Aileron plans announced. See Ch. 19 index listing.

Chapter Section II, Engine Installation & Systems
CP Issue 11-5
Subject fuel system
MAN/GND Plans & discussion for 3 tank fuel system.

Chapter 8
CP Issue 11-7
Subject attach fitting
MAN/GND Apply 2 ply UND wrap around attach fitting.

Chapter 4
CP Issue 10-3
Subject lift tabs
Install nut plates behind lift tab insert. Do not use method shown in the plans. Other hints for lift tab installation.

Chapter 3
CP Issue 12-7
Subject hot wire cutting
MAN Mod to templates helps cut straighter leading edges. Other hints for hot wire cutting.

Chapter 19
CP Issue 12-18
Subject ailerons
MAN/GND Install rear wing ailerons. Last minute addition to CP announces availability of aileron plans & how to get them. Explains why ailerons are needed.

Chapter 20
CP Issue 11-4
Subject roll trim
Roll trim is mandatory on the VE.

Chapter 21
CP Issue 11-6
Subject fuselage tank
MAN/GND Plans for fuselage tank. Discussion of 3 tank fuel system.

Chapter Section II, Engine Installation & Systems
CP Issue 11-8
Subject fuel system
Do the fuel flow tests (step 12) for WING AND FUSELAGE fuel. CP lists other plans changes due to 3 tank system.

Chapter 21
CP Issue 10-6
Subject drains
MAN/GND Install drains in forward part of wing tanks. CP gives drawing showing how to install them.

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Chapter Section II, Engine Installation & Systems
CP Issue 65-7
Subject fuel lines
MAN/GND Carefully examine every inch of urethane fuel line in all VariEzes. Some have disintegrated.

Chapter Section II, Engine Installation & Systems
CP Issue 65-13,7
Subject controls
MAN - 10 HRS Inspect throttle & mixture springs for proper installation & wear. Failure of these springs caused an engine failure.

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THE CANARD PUSHER No. 70 Jan 92

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 70.
VariViggen (2nd Edition), newsletters 18 to 70.
VariEze (1st Edition), newsletters 10 thru 70.
VariEze (2nd Edition), newsletters 16 thru 70.
Long-EZ, newsletters 24 through 70.
Solitaire, newsletters 37 through 70.
Defiant, newsletters 41 through 70.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every effort to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

ACTIVITIES AT MOJAVE

Burt's helicopter is being kept quite busy these days by Doug Shane and Mike Melvill who are in the process of getting their commercial rotorcraft ratings. They have discovered that flying helicopters is a real challenge and, also, lots of fun. To be able to fly over the hills to the North or West and land in a small clearing or on top of a mountain peak is something you could not even consider in a fixed wing. Just last week Mike landed in a clearing and saw bear tracks in the snow! The helicopter really adds a new dimension to flying.

Speaking of new dimensions in flying, Doug and Mike recently completed the live gunfire testing on the ARES. The ARES, of course, is a single seat, single engine jet fighter with an empty weight around 3800 lbs. and a gross weight of 6800 lbs. The GAU-12U Gatling gun shoots 25mm

bullets (almost 1" dia.!) at a rate of 1800 rounds per minute (30 shots per second) and has an average recoil of 7000 lbs.!

The testing began with ground firing at the Mojave police pistol range and the first couple of bursts were fired remotely. Then the two pilots took turns firing short bursts, gradually building up to maximum burst of 40 rounds. The second phase was firing in level flight and this was done over the China Lake Naval Weapons Center range. The final testing consisted of air-to-ground strafing which was conducted at China Lake and, also, at the East Mojave Range 9 miles east of Mojave Airport in the Edwards AFB restricted area. Both pilots greatly enjoyed the gunfire testing, especially the air-to-ground. The ARES was heavily instrumented and the data was recorded on each flight test. The composite structure of the ARES easily handled the blast pressures (in excess of 100 psi) and the recoil loads. Neither Doug nor Mike had ever fired a large gun in an aircraft and it was a tremendous thrill and a challenge to try to hit the target.

The testing was completed on schedule and the results were very satisfactory. A lot of people were skeptical that such a small airplane could successfully shoot such a big gun. Burt was confident that a composite airplane could do it and he was proven correct yet again!

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FLY-INS

KANSAS CITY GRAZIN' IN THE GRASS

The planning for the Kansas City GIG for 1992 is in the early stages, and I hope you can arrange to attend the fly-in on June 12-14, exclusively for composite canard designs. Last year was the first year for the event and 67 beautiful EZs flew in from all over the country and drew over 180 builders, flyers, friends, and family members to share in our common bond (Yes, epoxy and friendships do hold most things together).

The event planners want to do their very best to encourage more of you to attend next year and make the activities as entertaining and beneficial as possible. The theme centers on operations and safety programs specifically for our types of aircraft. Programs are planned for builders and fliers, plus all the ramp rap, flying, and friendship forming you can imagine. There's no better way or better place to find the experts and discuss your issues. It's non-commercial and held on a big, lightly used controlled airport right in the middle of the country (Johnson County Industrial, KIXD--Olathe, Kansas).

So if you came last year, thanks for the support and hope you can make it a second time. If this is a first time consideration, it would be great to see you, whether by bus, train or homebuilt. The goal is 100 plastic pushers! Make sure one of them is yours!

June 12, 13, 14, 1992 -
Johnson County Industrial Airport, (KIXD), Olathe, KS.
Second National Gathering for Canard Type Airplanes.

Social events, races, seminars, prizes.

Contact: Terry Yake
8904 West 116 Terr.
Overland, KS 66210-1963
913-451-8904

LETTERS

"REALISING THE DREAM

As an aeroplane nut from birth who qualified as an aerodynamicist, I have always wanted my own aircraft but would never be satisfied with a 172 or a Cherokee bludgeoning its way through the air. It became evident that to obtain the aeroplane to which I aspired, I would have to built it and several times I have started to put my ideas on paper. However, when Jim Bede publicised his BD-5, he really caught my attention. Gliding is my sport of preference and the modern sailplane is a wonderful melding of structure and aerodynamics which fills me with joy to pilot or simply behold. The BD-5 concept took many of the best aspects of a sailplane and added an engine to make a very efficient travelling machine but the reality, as we now know, proved more difficult.

Then when I read of the VariEze, despite its terrible name, I was really hooked. This offered most of the same things as the BD-5 plus two seats and range. Also, I felt happier with the idea of working in glassfibre than metal. By the time I got organised, the Long-EZ was the way to go and I sent off a cheque for the plans, feeling then as I do now, that that was the best value for money I have ever had. I budgeted and planned for 2-1/2 years (3 winters) to completion and got stuck in. I worked mostly alone in the garage at my home which meant that I could work most days and all hours. The fuselage progressed well and I started on the canard. Hot wire cutting the foam is a beautiful experience and the satisfaction obtained from creating a superbly contoured artifact from blocks of foam, rolls of glass and tubs of glop is really fantastic. Next came the wings which took most of the room in the small garage and by this time I was shuttling components back and forth to the hangar.

After about 18 months, my work situation changed and left me with less time and energy for the Long-EZ and occasionally the project bogged down for weeks at a time and I fell behind schedule. The thought of giving up did sometimes come into my mind but some serious daydreaming of setting off for a sunny Mediterranean airfield it my own creation quickly re-motivated me.

The fuselage with the main spar fitted would not have come out of the garage door so that job had to be done at the hangar and, once the winglets were on the wings, there was barely room for them in the garage either. The hangar was freezing all winter and too hot in summer so progress slowed considerably. As another setback, I spent a full summer with my leg in plaster, hobbling around the now assembled airframe, making painfully slow progress.

I called on a friend to paint the wings over a couple of week-ends but instead he (and others) spent hundreds of hours preparing a finish so good that I paid a professional to do the painting so as not to degrade the result of their efforts. The friend recruited to complete the wiring installation took all the time necessary to do a thorough job. This involved many weekends and so more months passed.

Last winter, the fifth, I was finally on the home straight, finishing the engine installation and the plumbing and I was motivated to work several times until after midnight in the hangar at sub zero temperatures. At the beginning of April '91 all was ready for inspection by Bureau Veritas (thirty minutes on the aircraft, two hours on the paperwork) and after two weeks I had the test flight authorization and had done runway tests, perhaps even a little hop. On the 30th everything was ready including the delegated first flight observer. The wind was really too strong and gusty (15 gusting 25) but it was right down the runway so I went for it.

The 20 minute first flight was a simple demonstration of that which was expected, I even had time to enjoy the thrill, followed by the best landing I've ever made. By that one flight, all the effort of the previous five and a half years was repaid. A thorough inspection showed all to be well but the wind continued to gust for a week almost directly across the runway so I did not fly again for some days. Frustration. After that the testing proceeded as planned, with 50 landings and 15 hours, including a flight to demonstrate the range, and I received the Certificate before the end of May. Since then F-PGEV has taken me to many destinations in France, to England, (including Wroughton) and Germany. With my girl friend, we flew to the Moulins fly-in and then continued our vacation via Gap, Frejus, Propriano in Corsica from where we visited most of the airfields on this beautiful island, back to Frejus, Perpignan, Carcassonne, Annecy and back to Paris. A fabulous shake-down trip with only one cowling removal all the way.

It is difficult to express the joy and satisfaction of completing what is not simply a flying machine but a thoroughly developed design exploiting up-to-date technologies to create a fast, efficient, safe and beautiful touring aircraft, but there are some ways in which the pleasure shows. For example, it's good to see the expressions on the faces of the people who you know were sure that you would never complete "that stupid looking aeroplane" when you tell them that you've just flown back from Munich in it. It's good, too, to share with others who have done the same, the comradeship that can only come from knowing what the other has done. Then intensity of the pride of ownership which could never come from something purchased can be almost overwhelming. One evening during test flying, I landed at dusk and went up to talk with the people in the tower. As we talked, the light went out of the sky and my aeroplane, the one that I made, was parked down there on the apron, highlighted in the apron illumination. I had to leave before they saw the tears in my eyes."

"This is a report of a stuck throttle "near-miss" incident. In hindsight, it is quite similar to the Don Patch report in CP 65 and the

Charles Hewison report in CP 66. I consider I was lucky to not have pranged the airplane.

I have just converted my Long-EZ from an MA-3A (non-accelerator pump carb) to an MA-4SPA (accelerator pump carb) as part of a change from an 0-235 C2C to an 0-320 E2G. After about seven hours of uneventful flying, I sent the MA-4SPA away for an overhaul, including a new throttle shaft and a rebuilt accelerator pump. This greatly improved the smoothness and mixture control of the engine but the rebuilt carburetor requires about two pound of force to operate, when applied to the throttle bellcrank arm at the inner most hole, using the plans carburetor cable bracket. The force to operate the throttle bellcrank is about the same whether or not the engine is running (two pounds). The MA-3A carburetor springs itself to full throttle, since it had no accelerator pump; the non-rebuilt

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MA4SPA was much looser than the rebuilt one. The problem is that the throttle quadrant is not able to supply this much force at idle without help from a spring. With a spring, the throttle sticking problem never occurred with the engine shutdown, only with the engine running after the throttle had been pulled to hard idle, and then slowly advanced.

I found this out over several days of trouble-shooting when I noticed the throttle response of the engine was occasionally delayed when coming off a slow idle. I investigated by cycling the throttle and visually inspecting the system, but could not reproduce the problem or find a cause for it on the ground. Being foolish and thinking the problem had fixed itself, I went flying, landed, and when I tried to apply some power to taxi, I could not get any power response, only a very spongy throttle movement to about half throttle position (2 inches of throttle knob motion). My first stealth forced landing! After engine shutdown, throttle response was normal!
(Good thing he did not have to go around! -ED)
I then verified visually (top cowl removed) that engine movement was not binding the cable somehow. I increased the throttle spring tension, and slightly relocated the throttle cable clamp to perfectly position the cable at the throttle cable end bushing. These changes appeared to eliminate the slow response. I flew again, and on landing, still had some reduced amount of sluggish response off of idle. Suspecting a damaged cable, I made the force measurements on the carburetor and the cable using some string, a volunteer to make the measurements with the engine running, and a 1-10 pound fish scale. These measurements confirmed that the system could not operate the carburetor without a spring assist. Suspecting damage to the cable, I then removed the cable from the airplane for inspection (yes, it was floxed in every foot or so: no, my consoles were not removable: yes, hell of a mess and lots of swearing). The cable was not damaged, nor was the cable sheath. Interestingly, however, if you pull on the cable shroud from opposite ends, even as little as 2 pounds of force will stretch it some.

I really didn't want to put a spam can-sort of throttle system in, but it appears that something with greater push authority than the original design is needed. I don't want to just increase the throttle spring

force since spring failure will mean possible throttle failure. Do you have any thoughts or suggestions?

Lew Miller"

Five years ago, Mike Melvill went to an aircraft push-pull throttle cable and has been pleased with the result. -ED

BUILDER HINTS

DEFIANT BUILDER/FLYER INFORMATION

Charlie Gray who has built and flown two Defiants sent us the following information:

"I have flown over 50 hrs. since July and found the nose gear steering getting harder and harder to steer. It has never been good but I thought that was normal as #1 was the same. Finally we were unable to steer without using brakes, not good in a crosswind. We have been flying into Merritt Island to see Johnny Murphy and crew for lunch almost every Saturday. Merritt Island has 11 - 29 runway, 3500' with a north crosswind at 15 kts. which makes for a wild landing each time.

I removed the complete nosegear assembly and found NG-11 and NG-12 frozen solid. The cross bolt hole had been elongated by app. 1/4". We made a new NG-12 with 1" dia. tube and put an Oil-Lite bearing inside.

Man, what a difference - - after flying this Defiant for almost 230 hrs., I am convinced that there has always been a problem. We have never had this good control on the ground or in the air. As you know, I put the rudders on the winglets and, although the brake-out force was high at high speeds, the rudders work very well. Now I find the brake-out force much less with more than enough rudder and nose gear control. The friction between NG-11 and NG-12 must have always been high, causing our problem.

I would recommend this to be a fix on all Defiants."

Editors comment:

Many thanks for the report, Charlie. This is the kind of feedback that is needed for those building

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and flying these airplanes. Your new home on the airpark sounds like a dream. Count on us flying by one of these days!

LONG-EZ MAIN GEAR MELT DOWNS

We continue to hear from at least one builder/flyer each quarter who has had this problem. We have reported on this problem several times in past Canard Pushers yet it continues to happen. The bad part is that each flyer who we hear from acts as though they had never heard of this problem and why weren't we warning people about it?! It is quite

frustrating for us at RAF because this is a problem that, frankly, does not need to happen - should never happen, in fact.

If you have a Long-EZ (or know of someone operating a Long-EZ) who is using the heavy duty brakes, this is what must be done to fix this potential problem. You must install heat shields between the axle mounting flange and the glass/epoxy main gear strut. This shield is purely a radiant heat shield and, as such, must be large enough to prevent the hot brake disc from "seeing" the gear strut. A fan-shaped, 1/8" thick aluminum heat shield that extends up above the brake disc by at least 1/2" works fine. You don't need any more than that. We have seen more gear legs damaged in this way than we care to think about and all of them had exactly the same damage: namely, the epoxy had been boiled or vaporized out of the glass strut directly opposite the brake disc. The damage was confined to an area the same shape and size as the disc. The damage can, and does, occur even through fiberfrax insulation. I repeat, this damage is caused by radiating heat from the red hot brake disc and is locally confined to a small section of gear leg directly opposite to and the same shape and size as the disc.

To our knowledge, this damage has only ever occurred when tight fitting wheel pants were installed. Apparently with no wheel pants, the disc gets enough cooling air flowing over it to keep it from getting hot enough to do this kind of damage. So - if you have tight fitting wheel pants, expect your brake discs to get very hot and protect the gear with an aluminum shield. In addition to the radiating heat damage, it is possible to generate enough heat inside an unvented wheel pant that this trapped oven-like heat can soften the epoxy and cause the gear strut to bend, usually at the highest point in the wheel pant. To protect against this kind of damage, you must wrap the strut from axle to the top of the inside of the wheel pant with Fiberfrax insulation, held in place with silicone (RTV). We have found wrapping over the Fiberfrax with aluminum tape makes a neat job and helps hold the Fiberfrax firmly in place. This will help the "oven heating" problem (as opposed to red hot radiation), but you must provide a place for this hot air to "chimney" out of the wheel pant. A vent of some kind is needed. This vent should be placed at the highest point in the wheel pant when parked, whether you park 3-point or nose down. This position may change a little depending on the wheel pant design. The important thing here is that the vent must be high to allow the trapped hot air to flow out and pull cool air in around the tire. These two fixes together will help prevent a softening of the epoxy-type failure.

The NACA scoop-type inlets and outlets we have all seen on wheel pants may have some value but you really need the cooling after you come to a stop. Cooling the brakes during braking probably has some value but these NACA-type cooling scoops are generally too low to allow good chimney venting when parked.

The single most important thing is not to conduct extensive braking/taxi testing with wheel pants installed. Do all initial taxi tests with no wheel pants. Once the airplane has been test-flown and signed off, generally you will not find a need to do extensive taxiing/braking. If you do have to check-out a new pilot, for example prior to his or her first flight in their own EZ, remove your wheel pants before you allow someone to practice for their first flight in your airplane.

If you have to taxi a long way with a strong crosswind, for example, the full length of a 10000 foot taxiway on a day with a 90 degree, 30 knot crosswind, you will have to ride one brake all the way. Under these circumstances, you might consider removing the affected wheel pant as soon as you park. This small inconvenience is tiny compared to getting stuck in some remote area, miles from home, due to a failed gear leg.

And if you are unfortunate enough to fail a main gear leg due to heat, contact Mike Melvill at Scaled Composites to borrow his steel splint that was made specifically to ferry a Long-EZ home with this problem. So far, it has been used on two Long-EZs and one Cozy and it will fit left or right Long-EZ main gear legs!

DEFIANT FLYER

If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's letter on his Ford-powered Defiant in the December issue is a case in point. See CP 67, page 2 for information on subscribing to the Defiant Flyer.

SHOPPING

CANARD PUSHER DIGEST, 2ND EDITION

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now in its 2nd edition. (For a complete description of the Digest, see CP57). Includes all builder related information from CPs 24-68. The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

CP Digest for the Long-EZ (2nd Edition) $75.00.
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel
Annual Update Subscription $25.00.
(4 updates)
Overseas orders add $5.00 for airmail.

Contact: Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704

714-839-4156

VARIEZE INDEX

Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. This index will be updated annually.

Contact: Bill Greer
222 McLennan Dr.
Fayetteville, NY 13066
315-637-3795

THE AERO ELECTRIC CONNECTION

is a book published for people who desire a working understanding of aircraft electrical systems and components. It is produced as a periodical publication of chapters on specific topics. For example, issue #1 covers d.c. electrical fundamentals, batteries, engine driven power sources, voltage regulators and grounding. Issue #2 continues over-voltage protection, low voltage warning systems, wiring, wire terminations and circuit protection. This first of a series of simplified wiring diagrams for composite airplane with high capacity alternators was published with issue #2. Issue #3 added diagrams for airplanes with and without starters plus versions using small permanent magnet, dynamo type alternators. A series of do-it-yourself avionics articles and kits are in planning. An entire issue will be devoted to providing a customizable book form wiring diagram for your airplane.

Contact: The AeroElectric Connection
Medicine River Press
6936 Bainbridge Rd.
Wichita, KS 67226-1008
316-685-8617

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00

Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE

Tie tacs-Long-EZ/VariEze (silver only)	6.50
Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
**Night photo by Jim Sugar new this year at Oshkosh	5.00

FOR SALE

LONG-EZ EXHAUST SYSTEM

All 321 stainless tubing 1-3/4" diameter with 1/4" thick stainless steel flanges. Pipes exit the cowling one above the other, two each side. Fits all Lycoming engines from 0-235 to 0-360 (no heat muff). This is the same exhaust system Dave Ronneberg designed and built and has been flying on his Long-EZ for several years. It is similar to the 4-pipe system Mike Melvill has on his Long-EZ, N26MS, for over 4 years and 600+ trouble-free hours.

Contact: Hal Hunt
6249 Longridge Ave
Van Nuys, CA 91401
818-989-5534

Note: Hal Hunt also makes and sells a neat air intake with filter and carb heat valve that provides filtered carb heat. Contact Hal for details.

NACA FRESH AIR INLET VENT DOORS.

Gene Zabler's neat little vent door is still available for $7.50 pp. Gene tells us that after 8 years in service some of these little doors are wearing out. If yours is, send an SASE and $2.00 to Gene and he

will ship you a new rubber insert. Gene also manufactures and sells a light weight nose wheel fender (protects your prop from gravel damage) for $45.00 pp.

Contact: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
414-886-5315

FLUSH RUDDER BELHORN SPRINGS.

Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049
NOTE: NEW ADDRESS FOR ORDERING

NOSE GEAR RATCHET

Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 pp. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.

Contact: Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES

New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $30.00 per set.

Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

ENGINE

Rotorway RW100 engine - new in the crate with accessories - liquid cooled, 108 hp, originally intended for my VariEze - $4500.00. VariEze canopy (clear) new, in the crate - $200.00.

Contact: Jay
602-497-5240

USED PARTS

Removed from 0-235 powered Long-EZ:

Brock exhaust system	$165.00
3" prop extension and crush plate	$165.00
Great American Prop, 62x62	$200.00

All used, but in good condition.

Contact: Steve Bowser
PO Box 83
Honeydew, CA 95545
707-629-3445

Please help! I have three aerosol cans of conductive copper paint. I paid $35.00 each for them when I bought them from Spraylatt Corp. Very effective to make an excellent ground plane for a Loran antenna.

Call or send $35.00 plus postage to
Peter Magnuson
573 G Carriage Shop Road
East Falmouth, MA 02536
508-540-5940

TOM BERKLEY'S HOT WIRE SAW

John has purchased a roll of the .041 diameter high temp, high tensile wire from the manufacturer as called out for Tom Berkley's saw. Two hundred and twenty feet was a minimum order and John is willing to sell his extra wire. He purchased his wire from The National Standard Co., Los Angeles Warehouse, 14700 S. Marquardt Ave., Santa Fe Springs, CA. 213-921-9683.

Contact: John Di Milia
92 Park Ave.
West Caldwell, NJ 07006
201-228-8966 (NEW NUMBER)

FEATHER LITE PRODUCTS

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00

Contact: Larry Lombard or
Mike Dilley at

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers: Bruce Tifft

B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received nothing but enthusiastic letters of recommendation for these props. See their ad in Sport Aviation.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

THERE ARE NO NEW CHANGES TO ANY AIRCRAFT IN THIS CP.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

ACCIDENTS AND INCIDENTS

The CP newsletter reports accidents and incidents and discusses their conditions and causes for information purposes for all operators. We have always investigated accidents in the interest of determining information that we can disseminate to you to prevent recurrence. It should be recognized in our discussion of accident conditions or causes that generally this information is preliminary since it is published before the availability of the FAA accident report.

A French VariEze was ditched off the coast of France when the engine quit while on short final to the Montpellier airport. Fortunately, neither the pilot nor the passenger were injured and, amazingly, the aircraft suffered relatively minor damage. This is the first known ditching of an EZ so we at RAF were most interested to read the report submitted to us by the pilot. We reprint the relevant information contained in his letter with the pilots permission and for the education of those readers who may fly this type of aircraft over water.

Pilot took off using the fuselage reserve fuel tank. Failed to notice the fuel valve position due to epoxy covered sleeve of coveralls. (VariEze fuel valve handle protrudes vertically into forearm when set to emergency reserve fuel tank). After 35 minutes of flight over beaches, the engine starved of fuel when the reserve tank ran dry. Pilot attempted to glide to runway, could not make it, so elected to land in the water due to bushes on approach end of runway. Pilot executed a normal landing on the surface of the water. He did extend the nose gear (but did not say if he extended the landing brake - RAF recommends both.) He touched down on the main gear at near minimum flying speed. The main gear instantly folded aft as the wheels penetrated the surface of the water. (This VariEze was equipped with a Long-EZ main gear strut and mounted similarly to a Long-EZ main gear mount). The nose gear did not collapse, but rather acted as a water "ski", preventing the nose from diving into the water. All of this happened very quickly according to the pilot, and although the stop was abrupt (he estimated less than 100 feet from

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point of touchdown 'til stopped), it was also gentle enough that he and his passenger did not even suffer any bruising from the seat belt/shoulder harnesses!

The fuselage filled rapidly with water and the pilot and passenger evacuated the aircraft after opening the canopy. The VariEze floated high enough in the water that the magnetos were above the water line and the instrument panel did not get submerged. The aircraft was pushed to the beach, the nose wheel was retracted and it was lifted up onto the beach with minimal damage.

The lower cowl was extensively damaged. The upper cowl, less so. Both ailerons were damaged and, of course, the main gear was torn completely out of the fuselage. The small plastic window used to check nosegear-down, was blown out by water pressure in the nose wheelwell. The ailerons have been rebuilt, both cowlings were replaced. The same main

gear strut has been reinstalled and the aircraft is once again in flying condition.

So, how could this have happened? In the pilot's own words: he was in too much of a hurry. He had not expected to go flying, he was wearing his epoxy-covered shop coveralls and did not take the time to change. He raced through his checklist and missed a few important items. He did not climb to the standard pattern altitude, and flew relatively low over the beach. He recommends always taking enough time to do all the things that must be done to accomplish a safe flight. If, in spite of all your best efforts, something goes wrong, keep you head, think about what you are doing, fly the airplane and control it all the way to touchdown, maintaining flying speed without fail. After his experience, he believes the VariEze to be an excellent choice for long, over-water flights! He says that if something goes wrong, simply land in the water, stay with the plane, it will provide you with protection and flotation while you wait to be rescued!

We certainly appreciate this pilot's candor, and we take our hat off to him for keeping his cool and making a safe landing into the water.
---,

A Long-EZ crash-landed in New Mexico when the pilot suffered a stroke while flying and attempted an emergency landing. The aircraft was considerably damaged, but the pilot sustained no serious injuries. Sadly, less than 3 weeks later, the pilot died after radiation therapy for several malignant tumors.

A VariEze crashed in Kentucky fatally injuring the pilot. The aircraft impacted the tops of trees at high power and finally struck a large tree trunk. The airplane burned and was totally destroyed. The pilot took off in adverse weather conditions and, at the time of the crash, a nearby airport reported near zero visibility. The pilot was instrument rated, had thousand of hours in his logbook and over 200 hours in type. Although it is difficult to understand how such an accident could happen, unfortunately, this is one of the most common general aviation type accidents. Weather can get you no matter how experienced you may be. If you have doubts about the weather, stay on the ground and try again when the weather gets better.

A Long-EZ crashed in Pennsylvania and the only person aboard was killed. The NTSB has not yet come out with a finding on this accident. All we have is a letter from the builder and a newspaper clipping. We talked with the FAA who assured us that they had found no evidence of an airframe problem and that, for some reason, the pilot was flying low down a river valley and struck an unmarked cable. The aircraft crashed into the river. What we do not know is whether the pilot was deliberately flying low or, perhaps, had a problem and was attempting an emergency landing. The cable has since been repaired and has had three red balls installed on it.

TRIBUTES

On Wings of Glass

Oh come along and fly with me
We'll ride across the sky.

My slender craft has wings of glass
And she can really fly.

This sleek and slender craft of glass
Is such a lovely thing.

She'll loop, she'll roll, she'll dance
The sky on white and shining wings.

She'll do so many things
That I've always dreamed.

So come along and ride with me,
I'll show you what I've seen.

We can fly across this land of ours,
We can cross the oceans deep.

We can sail along on wings of glass
Above the mountain peaks.

This sleek and slender craft of glass
Can take us farther than you think.

The adventure of our travels
Will give us memories to keep.

So come along and fly with me.
We'll ride across the sky.

Our slender craft has wings of glass!
And we can really fly!

David M Haggard

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

David Coulter of Salt Lake City with his Solitaire model - and a happy smile!

Another happy man. Chuck Charles coming back from first flight in his VariEze, N23CE, on December 11, 1991. Congratulations, Chuck!

Scaled test pilot, Doug Shane, fires a 40-round blast with the General Electric GAU-12U Gatling gun in ARES at the Mojave Range. Fire balls like this were typical both on the ground and in the air.

Canard Pushers from 1 to 82

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THE CANARD PUSHER No 71 Apr 92
Published quarterly (Jan., April, July, Oct.) by

RUTAN AIRCRAFT FACTORY, INC.
Building 13 - Airport
Mojave, CA 93501
805-824-2645

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Back issues $3.50

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VariViggen (2nd Edition), newsletters 18 to 71.
VariEze (1st Edition), newsletters 10 thru 71.
VariEze (2nd Edition), newsletters 16 thru 71.
Long-EZ, newsletters 24 through 71.
Solitaire, newsletters 37 through 71.
Defiant, newsletters 41 through 71.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every effort to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

WARNING - STRUCTURAL DEGRADATION OF FOAM CORES

We have noted that many of you have not been adequately inspecting your structure and may not be aware of how seriously the structure can be affected by a degradation or defect in the underlying foam core. For example, a 3-inch diameter depression or bulge in the skin due to damage in the foam (void, crush or de-lam) can weaken a winglet or wing (particularly a VariEze outboard wing that has no discrete spar) by as much as 50% or more! A skin dis-bond on an elevator or aileron can result in flutter failure even within the allowable flight envelope.

We have recently found foam damage to several of our own aircraft structures. One was due to the inadvertent intrusion of an agent used to clean a wing before it was primed and painted. Another was traced to a stress crack that was in the foam block, a flotation billet, not the proper fabrication billet. Never substitute a different material even if it seems to work okay. We have also had dis-bonds in control

surfaces. These can grow rapidly when exposed to high altitude flight. (The void is trapped and expands at altitude).

The solvent-susceptible and easily-damaged cores we use need constant attention to maintain safety. We know of no accidents due to this problem, however, the potential is high if you are careless with the maintenance of your airplane. Please let us know what you find on your inspections so we can pass this on to everyone. Since these types of structures are used on non-RAF types, we are asking Sport Aviation to also publish this caution.

FLY-INS

KANSAS CITY GRAZIN' IN THE GRASS

DATE CHANGE

A recent change in airport administration thinking has caused us to change the date from what has previously been advertised.

June 5, 6, 7, 1992
Johnson County Industrial Airport, (KIXD), Olathe, KS.

Second National Gathering for Canard Type Airplanes.
Social events, races, seminars, prizes.

Contact: Terry Yake
8904 West 116 Terr.
Overland, KS 66210-1963
913-451-8904

FALL FESTIVAL OF FLIGHT

September 26 & 27, 1992
New Castle county airport
Wilmington, Delaware

EAA East Coast Fall Festival of Flight
"Milestones in Aviation"
Award judging Saturday & Sunday
Forums, Parade of flight, Fly-bys, exhibits, vendors, aviation celebrities,
Pancake breakfast, fast foods, Saturday dinner,
Mode C waiver & no-radio procedure

For info packet contact:
EAA East Coast Fly-In Corp.
2002 Elnora St.
Wheaton, MD 20902-2706
301-942-3309

SHOPPING

CANARD PUSHER DIGEST, 2ND EDITION

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now in its 2nd edition. (For a complete description of the Digest, see CP57). Includes all builder related information from CPs 24-68. The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

CP Digest for the Long-EZ (2nd Edition) $75.00.
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel
Annual Update Subscription $25.00.
(4 updates)
Overseas orders add $5.00 for airmail.

Contact: Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

VARIEZE INDEX

Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. This index will be updated annually.

Contact: Bill Greer
222 McLennan Dr.
Fayetteville, NY 13066
315-637-3795

DEFIANT FLYER

If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's letter on his Ford-powered Defiant in the December issue is a case in point. See CP 67, page 2 for information on subscribing to the Defiant Flyer.

THE AERO ELECTRIC CONNECTION

This is a book published for people who desire a working understanding of aircraft electrical systems and components. It is produced as a periodical publication of chapters on specific topics. For example, issue #1 covers d.c. electrical fundamentals, batteries, engine driven power sources, voltage regulators and grounding. Issue #2 continues over-voltage protection, low voltage warning systems, wiring, wire terminations and circuit protection. This first of a series of simplified wiring diagrams for composite airplane with high capacity alternators was published with issue #2. Issue #3 added diagrams for airplanes with and without starters plus versions using small permanent magnet, dynamo type alternators. A series of do-it-yourself avionics articles and kits are in planning. An entire issue will be devoted to providing a customizable book form wiring diagram for your airplane.
Contact: The AeroElectric Connection
Medicine River Press
6936 Bainbridge Rd.
Wichita, KS 67226-1008
316-685-8617

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00

Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00

FOR SALE

LONG-EZ EXHAUST SYSTEM

All 321 stainless tubing 1-3/4" diameter with 1/4" thick stainless steel flanges. Pipes exit the cowling one above the other, two each side. Fits all Lycoming engines from 0-235 to 0-360 (no heat muff). This is the same exhaust system Dave Ronneberg designed and built and has been flying on his Long-EZ for several years. It is similar to the 4-pipe system Mike Melvill has on his Long-EZ, N26MS, for over 4 years and 600+ trouble-free hours.
Contact: Hal Hunt
6249 Longridge Ave
Van Nuys, CA 91401
818-989-5534

Note: Hal Hunt also makes and sells a neat air intake with filter and carb heat valve that provides filtered carb heat. Contact Hal for details.

NACA FRESH AIR INLET VENT DOORS.

Gene Zabler's neat little vent door is still available for $7.50 pp. Gene tells us that after 8 years in service some of these little doors are wearing out. If yours is, send an SASE and $2.00 to Gene and he will ship you a new rubber insert. Gene also manufactures and sells a light weight

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nose wheel fender (protects your prop from gravel damage) for $45.00 pp.
Contact: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
414-886-5315

FLUSH RUDDER BELHORN SPRINGS.

Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!
Contact: John York
903 W. 24th Street
Lawrence, KS 66046

913-832-2049

NOTE: NEW ADDRESS FOR ORDERING
NOSE GEAR RATCHET

Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 pp. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.
Contact: Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES

New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $30.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

FEATHER LITE PRODUCTS

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00
Contact: Larry Lombard or
Mike Dilley at
Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

Standard 500x5 wheels and brakes - never used - $200.00.
Contact: John Vukos
7386 Darrow Rd.
Neenah, WI 54956

Curt Smith's nose gear ratchet assy. new-	$30.00
Westach combination CHT-EGT	30.00
Alcor bayonet CHT probe & pipe adapter	25.00
3/32" a/c cable w/swaged fork end	25.00

Contact: Dan Worley
11019 Woodley Ave.
Granada Hills, CA 91344

Starter (MZ4204) for 0-235 - yellow tag	$150.00
Carburetor - used	400.00
Facet fuel pump - new	20.00
Essex primer pump - new	30.00
Carb heat valve - new	50.00
Landing brake parts - new	50.00

Throttle assembly - new 60.00
Lycoming mechanical fuel pump 100.00
(LW15472 - used)
Contact: Ron Verderame
414 Second St. #244
Hermosa Beach, CA 90254
310-374-2061

EZ flyers can now have a 1/48th scale model of their VariEze or Long-EZ. An existing plastic model kit is used to obtain the fuselage, wings & winglets. Strakes, canard & wheel pants are made from materials of the builders choice. Plans are $10.00.

Contact: James Plans
Bill James
3424 Wren Ave.
Fort Worth, TX 76133

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:
Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received nothing but enthusiastic letters of recommendation for these props. See their ad in Sport Aviation.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

THERE ARE NO NEW CHANGES TO ANY AIRCRAFT IN THIS CP.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

MAN-GND

ADD THE FOLLOWING TO THE MAINTENANCE/INSPECTION SECTION OF VARI-VIGGEN, VARIEZE, LONG-EZ, DEFIANT AND SOLITAIRE OWNERS MANUALS.

PREFIGHT CHECKLIST

Check all skin surfaces of wings, canard, winglets and control surfaces for cracks, dents, or bulges and for evidence of interior foam damage (skin moves when you push on it or has a dull thud if tapped with a coin). Do not fly if structure is damaged beyond the limits noted in the 25-hour inspection (page 46).

COMPOSITE STRUCTURE

WARNING - The foam core in composite control surfaces, wings, canard and winglets is easily damaged by solvents, including solvents found in paint primer, most cleaning products and, of course, oils and fuel. Never wash the structure with anything but soap and water. The smallest invisible pinhole through the epoxy surface structure can allow intrusion of liquids or vapors that will attack the styrofoam core. A void or dis-bond (separation from the skin) will weaken the structure and can result in a fatal accident. The foam core can also be damaged by local concentrated loads such as a dropped tool or by using your shoulder to set the gear. Never use a wing as a workbench or to stack luggage. Treat all composite skins like eggshells.

EACH 25 HOURS Conduct a general inspection of all composite structure. Any visible crack must be investigated to determine if it is only paint and filler damage or if it extends into the fiberglass structure. All paint and filler cracks should be repaired or sealed to prevent water intrusion. All fiberglass damage must be re-painted before flight. Check skin surfaces for evidence of depressions or bulges that indicate a failure of the underlying foam core. Note the integrity of the underlying core by pushing on the skin and tapping with a 25-cent coin. Good core is indicated by a sharp "tap" or "knock" noise. Bad core is indicated by a "dull thud". Listen carefully as you tap and mark with a grease pen directly on the skin the boundary of any suspected dis-bond area. Ground the aircraft if any core damage area is larger than the following:

Fuselage, wing/canard - 3" diameter.

Winglet, control surface or VariEze outboard wing - 2" diameter.

Repair per instructions in the annual/100 hour below.

ANNUAL/100 HOUR Conduct a very careful 100% skin surface coin tap, surface stiffness and contour smoothness inspection. Include interior areas in fuselage, cowl and wing with wings removed. Repair all suspect areas (even 1" diameter ones) by drilling #50 holes and injecting epoxy in one side of the void/bulge/dent area until the epoxy vents out the bulge (any divergence from the intended smooth contour) must also be repaired and reinforced per the standard repair methods in the plans.

MAN-GND - VARIEZE

ALL HM-3 ROD ENDS MUST BE REPLACED BY HM-1/4-28 ROD ENDS BEFORE NEXT FLIGHT AS PER CP20, PAGE 4.

SEE ARTICLE THIS ISSUE, THIS PAGE, LAST PARAGRAPH AND NEXT PAGE FIRST PARAGRAPH.

IMPORTANT REMINDER

Do not omit the required placard for minimum pilot weight. Keep in mind that someone other than you may someday fly your airplane. If that someone is not as heavy as you are, he or she may take-off with an out of CG, aft condition that could cause an accident.

LICENSE AGREEMENTS

RAF continues to receive requests for new license agreements on Long-EZs, Defiants, Etc. This is particularly true from foreign countries. Pleas understand. RAF cannot issue any new license agreements to anyone for any reason. This is final , official and irrevocable.

DEEP STALL TEST PROGRAM

Some work has been done on how to conduct this test but because we do not have an aircraft (Long-EZ), we have not built any hardware. We have so far received offers of two Long-EZ airframes, one structurally complete with no finish, no engine or cowling. The other has been modified and is not a stock Long-EZ shape.

RAF desperately needs a plans-built Long-EZ, complete, including cowling (engine not required). What we really need is a Long-EZ that has flown (is contoured and is complete) but is not currently being flown for some reason. We will have to cut holes in the bottom of each baggage-strake area and mount a pivot on the vertical and longitudinal CG. The airplane will then be mounted on a custom built trailer using these two pivot mounts and will be ballasted using lead shot bags to the various CGs we want to look at. This "damage" (holes in strakes) will be repaired by RAF prior to returning the airplane.

If you know of a Long-EZ such as this that may be available, please let us know. Possibly someone has one they are no longer flying but they don't get this newsletter. PleasE contact the owner or let us know who and where he or she is.

DASH 3 ROD ENDS IN VARIEZE PITCH CONTROL SYSTEM.

We were shocked to hear from a VariEze builder/flyer who had a failure of one of the rod

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end bearing in his pitch control push rod. This rod end was an HM-3 (10-32) and should have been a HM-4 (1/4").

This mandatory change was called out in CP20, page 4. The four HM-3 (10-3) rod ends in the pitch control linkage must be removed and replaced with HM-4 (1/4-28) rod ends. Check your VariEze before next flight. Replace all HM-3 rode ends with HM-4s. DO NOT FLY WITH HM-3 ROD ENDS.

SHOP AIR AND FOAM CORE WINGS

High pressure shop air can cause serious dis-bonds between skins and foam cores. Be extremely careful using shop air to blow off a wing, winglet, canard, etc. If there is a small hole such as a drilled hole for wiring, antennas, etc. and the high pressure air gets into this hole, it will literally blow the skins off the surface. We have had it happen to us and we have had several reports from homebuilders who have had this problem. Sometimes it can be repaired fairly simply - other times, it can be a really tough repair. The answer is not to get into this situation. The greatest danger would be if it occurred and went undetected. This could lead to a structural failure and a serious accident. See "Warning" in this newsletter for information on "tap" testing for dis-bonds.

LETTERS

"Dear RAF,

My Long-EZ, N60AK (Ser.#1172), has 900 hours since first flight in Aug. 1985. I have had no significant problems other than the Nyflow brake lines which always leaked at the fittings on the brake end. I switched to Stratoflex hose and have had no problems since.

I have had some problems with paint bubbling, particularly on the upper surface of one strake. All bubbling is on the upper surfaces that are exposed to the sun (when we get it). The bubbling seems to get worse when I fly to the "lower 48" and is exposed to higher airport elevations, higher ambient air temps and more direct solar radiation then here in Alaska.

The airplane has been a joy to fly and is great for transportation. A couple summers ago, I flew up over the ice pack on the Arctic Ocean north of Alaska (just for kicks). Has anyone else done that with an EZ? That may be my only claim to fame in life, such as it is.

Jerry Nibler
Anchorage, AK"

"Dear RAF,

Just a note to pass along some information that might be of interest to your builders.

I recently contoured my Long-EZ using West System epoxy and West System 410 Microlight filler rather than glass bubbles.

The 410 sands a little easier that "micro" and seems to be less prone to developing pinholes. The biggest advantage, however, is that it takes about 1/3 the time to mix with the epoxy and there is much less airborne loss while mixing.

Jim Smith
Logan, UT"

Editor's note: We have also used 410 Microlite filler and found it very easy to sand and essentially all the dust falls to the floor (does not become airborne particles nearly as bad as does micro). However, the 410 is softer than micro and more easily damaged. For this reason, it should never be used along any leading edges (wings, winglets, canard, nose area back a foot or so, etc.). The only other disadvantage is the cost - it is fairly expensive - but may be worth it since it mixes quicker and is much faster to sand to contour.

FAIR WINDS

CARTOON OMITTED

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THE CANARD PUSHER No 72 July 92
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BURT'S TALKS AT OSHKOSH 1992

Saturday, August 1 - 10:00am/11:15am
Life, the Universe & Everything Else,
Part II-Speakers-John Roncz and Burt
Rutan - Rutan Aircraft Factory, Inc.

Sunday, August 2-8:30am/9:45am(Design College)
Tent Talk Show - Moderator: Burt Rutan
with Special guest, John Roncz.

Sunday, August 2 - l0:00am/11:15am
Rutan Homebuilts - VariViggen, VariEze,
Long-EZ, Defiant and Solitaire - Speaker -
Burt Rutan - Rutan Aircraft Factory, Inc.

Monday, August 3 - 10:00am/ll:15am
The Latest Developments from Mojave
Speaker - Burt Rutan - Scaled Composites, Inc.

BURT/RAF WIN LAWSUIT

A VariEze accident reported in CP61 in which two people were fatally injured resulted in a lawsuit being brought against Burt Rutan, Rutan Aircraft Factory and Scaled Composites. Very early in the case, there was a ruling that Scaled Composites, Inc. has no connection with the VariEze design

Testimony which came out during the trial indicated that the builder had constructed his own wing attach mechanisms, including the four taper pins that hold the wing in place...and that the workmanship was not to a high standard. On the morning of the accident, the builder had the wings off his VariEze and in the course of reinstalling them, left out two of the four taper pins. During the ensuing fatal flight, the aircraft was observed doing aerobatics, and subsequently crashed, killing both occupants. Post crash tests revealed that the pilot was intoxicated (by FAR 91 definition). During the course of the trial, RAF presented evidence showing that testing it had done on a stock VariEze...to destruction...proved that the type of failure that had occurred could not have happened even with the two taper pins omitted as long as the aircraft had been operated within its design envelope. Only loads far in excess of the VariEze's design limits could have caused such a failure, Burt and RAF testified...and, in the end, the jury agreed.

The cause of the accident, the jury decided, was negligence on the part of the builder/pilot.

This lawsuit may well turn out to be a legal landmark...one that changes the way suits against homebuilt plans/kit business are defended. Burt Rutan has put the litigious society on notice that if he is sued, there will be no out-of-court, pre-trial settlements; the case will be aggressively defended; and that when he wins, he will go after the costs he has incurred in defending himself.

Burt feels there were many aspects of the trial that will be of interest to EAAers, so he will devote a portion of one of this Oshkosh '92 forums to it. His forum entitled "Mojave Update", set for 10:00am on Monday, August 3, is being changed to "Mojave Update and Liability Issues" and may include Burt's attorney, Lee Horton, if his schedule permits. Burt's forums are always standing room only, so it will be advisable to come early for this one.

FOLLOW-UP ON CP71 DISBOND/DELAM CAUTION

So far, we have received only one letter from a builder with a problem in this area. This aircraft is a Q-2 and, normally, we would not presume to comment on someone else's design but this particular problem

could so easily have resulted in an in-flight structural failure that we felt morally obligated to say something about it.

During a landing that the pilot said was not any harder than other landings he had made, the canard (also the landing gear since the main wheels are mounted on the tips of the canard) failed. The top skin just inboard of the fuselage side, buckled and the canard folded. Subsequent sectioning of this area showed a large percentage of the foam had "melted". This builder/pilot suspected that this melting damage was caused by excessive heat from the sun while tied down outside in Florida. He included three photographs of the section of damaged canard.

We at RAF have not seen this canard, only the photos, but we have a different opinion. We believe this damage may have been caused by fuel leaking out of the fuel tank (above the canard) and seeping through tiny pinholes in the top skin and melting the foam. Styrofoam, be it blue or orange, fabrication billets or floatation billets, will melt when it comes in contact with any fuel, solvent, etc. Put a scrap of foam in a container of fuel and, in a short period of time, the foam will disappear. Pour a little fuel, avgas or mo-gas onto a block of foam and you will be amazed at the damage. The three photos supplied to us by this Q-2 builder/pilot, in our opinion, show classic fuel or solvent damage. One of Scaled's employees who has built a Quickie and a Q-2 informed us that the fuel tank is, in fact, mounted directly over the canard and that he had heard of this type of foam damage before.

All of the RAF designs have a fuel-proof barrier between fuel and Styrofoam. This barrier can be a sandwich panel of glass/PVC foam/glass, or glass/urethane foam/glass, but RAF feels it is absolutely essential to completely protect any Styrofoam core structure from exposure to fuel or any kind of solvent. In some cases, even the fumes of fuel or a solvent such as MEK or acetone can degrade a foam core to the point of causing a possible structural failure.

We have written a letter to this particular Q-2 owner and will be passing this information on to Jack Cox, editor of Sport Aviation. We are not criticizing anyone, it's just that this kind of damage is many times invisible and may not easily be spotted in a normal preflight. Any foam core, glass structure, while perfectly safe with an undamaged core, can become prone to catastrophic failure if the foam core is damaged. This kind of hidden damage could cause a serious accident. This is our only reason to bring this to everyone's attention.

To protect yourself from this kind of failure, it is critically important to prevent fuel from coming into contact with a glass structure that has a Styrofoam core. The same goes for any form of solvent, be it MEK, acetone, Prep-Sol, Acrylikleen, or whatever.

To check your structure for possible delamination or dis-bonds, move the airplane into the sun or, at least, to where it is warm. This will cause any disbonded areas to bubble up due to the air or gas in the void heating up and expanding. Carefully tap the entire area using a quarter (25-cent piece). Listen carefully for the telltale "hollow" sound when you tap an area that

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is disbonded or delaminated as opposed to the solid "click" sound of normal structure. By carefully tapping and using a felt tip pen to mark the perimeter of the damaged area, you can outline any areas that need repair then you can repair these areas, in most cases, simply by injecting a mixture of epoxy and micro-balloons, using a syringe. You will have to drill a number of small holes (to closely fit the needle) and inject the epoxy mix into one hole until it comes out of adjacent holes. Keep moving the syringe around until forcing it into any hole will make it come out of the holes closest to that one. Now, move the airplane out of the sun into a cooler area. Place some plastic (Visqueen) over the area, cover that with a piece of flexible material (.032 aluminum) and place a lead shot bag on top of that. As soon as the epoxy in the cup has kicked off, remove the lead shot gas, the aluminum and the plastic. Carefully scrape the excess epoxy off the paint using a plastic putty knife. After a full cure, you can carefully polish this area and repaint. Sometimes the visual damage is so little it does not require repainting. Recheck the area by tapping with a quarter to assure that you completely filled all void areas.

KC-GIG, 1992

Three Long-EZs headed East from Mojave - Shanes, Melvills and Kreidels. The flight was via Loran, direct, a distance of 1140 nautical miles over some pretty imposing terrain. All three have oxygen, so the flight was conducted at 17,500 feet. Flight time was 6:50 hours and each used approximately 40 gallons of gas. There was almost 20 knots of tailwind but, even so, the numbers aren't bad - average speed was 168 knots (193mph) and 28nmpg (32mpg). Except for some dodging of thundershowers in the Durango, CO area, the weather was great.

At least 67 aircraft flew in during the weekend in spite of low ceilings and visibilities on Saturday. Several builders/flyers removed their cowlings and were soon surrounded by other builders who asked lots of questions and, hopefully, got helpful answers. This is really a neat format for learning. Gary Hertzler had his very fast, efficient VariEze there and held a well-attended forum on the many mods and clean-ups he had done on his little jewel.
The dinner on Saturday evening was held in the same beautiful facility as it was last year and the featured speaker this year was a local airforce reserve pilot, Lt. Col. Roger Disrud. Roger won the Top Gun competition at the airforce's Gunsmoke competition at Nellis AFB in Nevada and he presented a great slide show and video of all the action. Roger also has restored a J-3 Cub to like-new condition and is a dyed-in-the-wool "little" plane enthusiast.

The trip home was uneventful except for a little more weather to dodge and a much higher fuel burn due to low altitude and high power settings against the normal headwinds.

The KC-GIG is really a fun fly-in and one that will hopefully be held courtesy of Central States group at the Johnson County Industrial airport south of Kansas City for many years to come.

FLY-INS

FALL FESTIVAL OF FLIGHT

September 26 & 27, 1992
New Castle county airport
Wilmington, Delaware

EAA East Coast Fall Festival of Flight
"Milestones in Aviation"
Award judging Saturday & Sunday
Forums, Parade of flight, Fly-bys, exhibits, vendors, aviation celebrities,
Pancake breakfast, fast foods, Saturday dinner,
Mode C waiver & no-radio procedure

For info packet contact:
EAA East Coast Fly-In Corp.
2002 Elnora St.
Wheaton, MD 20902-2706
301-942-3309

SHOPPING

CANARD PUSHER DIGEST, 2ND EDITION

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now in its 2nd edition. (For a complete description of the Digest, see CP57). Includes all builder related information from CPs 24-68.

The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

CP Digest for the Long-EZ (2nd Edition) $75.00.
Overseas orders add $20.00
for airmail, otherwise, it will
be sent via surface vessel
Annual Update Subscription $25.00.
(4 updates)
Overseas orders add $5.00 for airmail.

Contact: Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

VARIEZE INDEX

Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. This index will be updated annually.

Contact: Bill Greer
8827 Larchwood Dr.
Dallas, TX 75238
214-348-0215

PLEASE NOTE: Those of you who have the first edition, Bill has improved the indexing of several topics and added more cross-indexing You may find it helpful to get an up-grade.

DEFIANT FLYER

If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's letter on his Ford-powered Defiant in the December issue is a case in point. See CP67, page 2 for information on subscribing to the Defiant Flyer.

THE AERO ELECTRIC CONNECTION

This is a book published for people who desire a working understanding of aircraft electrical systems and components. It is produced as a periodical publication of chapters on specific topics. For example, issue #1 covers d.c. electrical fundamentals, batteries, engine driven power sources, voltage regulators and grounding. Issue #2 continues over-voltage protection, low voltage warning systems, wiring, wire terminations and circuit protection. This first of a series of simplified wiring diagrams for composite airplane with high capacity alternators was published with issue #2. Issue #3 added diagrams for airplanes with and without starters plus versions using small permanent magnet, dynamo type alternators. A series of do-it-yourself avionics articles and kits are in planning. An entire issue will be devoted to providing a customizable book form wiring diagram for your airplane.

Contact: The AeroElectric Connection
Medicine River Press
6936 Bainbridge Rd.
Wichita, KS 67226-1008
316-685-8617

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00

Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00

NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00

FOR SALE

LONG-EZ EXHAUST SYSTEM

All 321 stainless tubing 1-3/4" diameter with 1/4" thick stainless steel flanges. Pipes exit the cowling one above the other, two each side. Fits all Lycoming engines from 0-235 to 0-360 (no heat muff). This is the same exhaust system Dave Ronneberg designed and built and has been flying on his Long-EZ for several years. It is similar to the 4-pipe system Mike Melvill has on his Long-EZ, N26MS, for over 4 years and 600+ trouble-free hours.

Contact: Hal Hunt
6249 Longridge Ave
Van Nuys, CA 91401
818-989-5534

Note: Hal Hunt also makes and sells a neat air intake with filter and carb heat valve that provides filtered carb heat. Contact Hal for details.

NACA FRESH AIR INLET VENT DOORS.

Gene Zabler's neat little vent door is still available for $7.50 pp. Gene tells us that after 8 years in service some of these little doors are wearing out. If yours is, send an SASE and $2.00 to Gene and he will ship you a new rubber insert. Gene also manufactures and sells a light weight nose wheel fender (protects your prop from gravel damage) for $45.00 pp.

Contact: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
414-886-5315

FLUSH RUDDER BELHORN SPRINGS.

Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049

NOTE: NEW ADDRESS FOR ORDERING
NOSE GEAR RATCHET

Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 pp. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it. Contact:

Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES

New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $30.00 per set.

Contact: Vance Atkinson

3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

FEATHER LITE PRODUCTS

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00

Contact: Larry Lombard or
Mike Dilley at
Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

EZ flyers can now have a 1/48th scale model of their VariEze or Long-EZ. An existing plastic model kit is used to obtain the fuselage, wings & winglets. Strakes, canard & wheel pants are made from materials of the builders choice. Plans are $10.00.

Contact: James Plans
Bill James
3424 Wren Ave.
Fort Worth, TX 76133

AIRWOLF FILTER CORP.

After 4 years of design and testing, Airwolf Filter Corp. is proud to release to the homebuilt market their Lycoming remote mount oil filter. This remote mount filter was designed to replace the 4-bolt Lycoming P/N 69510, 68974, or 62815 oil screen housing at the rear of most Lycoming 0-235, 290, 320, 340, 360, 540, and 720 series engines. This adapter allows the user to locate the oil filter to the firewall and is a welcome relief since many Lycoming engine applications are unable to use the current spin-on adapters due to space restrictions. In addition this kit, including the oil filter, adds less than 4 pounds to the aircraft empty weight.

The AFC remote mount oil filter kit is available in three versions. 1) The basic kit includes only the oil filter adapter and remote oil filter mounting plate and retails for $495.00. 2) The deluxe kit includes the oil filter adapter, remote oil filter mounting plate, spin-on oil filter, Aeroquip steel braided hose and fittings, AN-8 fitting and bulkhead nuts, Vitron O-rings, Teflon washers and is priced at $695.00. 3) Remote filter adapter (allowing the homebuilder to use his own oil filter mounting base) for $395.00.

The entire remote mount filter installation should take only 1 to 2 hours to install in most applications.

The public release of this product will be at Oshkosh 1992 and our booth is 368E in the Fly Market.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received nothing but enthusiastic letters of recommendation for these props. See their ad in Sport Aviation.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

THERE ARE NO NEW CHANGES TO ANY AIRCRAFT IN THIS CP.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

IMPORTANT REMINDER

Do not omit the required placard for minimum pilot weight. Keep in mind that someone other than you may someday fly your airplane. If that someone is not as heavy as you are, he or she may take-off with an out of CG, aft condition that could cause an accident.

LICENSE AGREEMENTS

RAF continues to receive requests for new license agreements on Long-EZs, Defiants, etc. This is particularly true from foreign countries. Please understand, RAF cannot issue any new license agreements to anyone for any reason. This is final, official and irrevocable.

LONG-EZ OIL COOLING

High oil temperatures continue to be one of the most frequently reported problems from builders/flyers of Long-EZs. As reported in CP 66, page 4, a rather detailed engine and oil cooling test and analysis was conducted by Bill Freeman. He found that it literally took doubling the size of the oil cooler to keep the temperature of the oil at the desired level. There are three Long-EZs based at Mojave that are owned and flown by employees at Scaled. All three have varying degrees of high operating oil temperatures. These three have all made numerous changes to try to lower operating oil temperatures. Among these changes were: new Vernitherms (thermostat - VERY EXPENSIVE!), different positions of oil cooler in the cowling, various configuration of inlet and outlet ducting to and from the oil cooler, the use of Mobil 1 (an exotic, high temperature synthetic oil), larger flexible hoses between the engine and the oil cooler, etc. None of these changes reduced the operating oil temperature consistently to the 1800-1900F that is desirable.

On Mike and Sally's Long-EZ, N26MS, with the oil cooler mounted on the firewall above the centersection spar, the oil temperature would vary from 1900F to 2300F depending on the outside air temperature (at similar power settings). Mike put up with this situation for several years because these temperature ranges were within those specified by the engine manufacturer. Recently, a top overhaul was conducted on his engine and after this overhaul, oil temperatures ran at or above 2450F red line.

Power had to be reduced soon after every take-off due to exceeding the oil temperature red line limit. A new Vernitherm made no perceptible change. Having Bill Freeman's test in mind, Mike installed a new oil cooler essentially twice the size of the stock cooler. This was installed on the lower cowl, left side, similar to the plans call-out. Oil temperature now remains between 1800 and 1950F even in a maximum power climb to 17,500 feet on a hot summer day. So far, the oil temperature has never gone below 1800F even at low cruise power at high altitude during the winter due, presumably, to a correctly operating Vernitherm. Nor has the temperature gone higher than 1950F and this only occurred in a full gross weight, maximum power climb in the middle of summer in the Mojave desert.

Dan Kreigh owns an 0-235-L2C powered Long-EZ here at Mojave and until he doubled the size of his oil cooler (by simply installing a second cooler in series) he had tried every one of the options in this article with little or no success.

His oil temperature consistently ran close to or at the red line. The second cooler has eliminated the problem.

This article is aimed at those builders/flyers who may have high oil temperature problems. If your oil temperatures are normal please disregard this recommendation.

AN ELECTRICALLY ACTURATED LANDING BRAKE BY MIKE MELVILL

This question has been asked many times. I remember discussing this with Burt on a number of occasions. The answer was always, "Why mess around with a nice simple, light-weight system that has never given any problems?". I agreed with this argument at that time and never seriously considered such an idea until recently.

Occasionally I heard from builders and flyers who had installed linear actuators but I did not take these seriously until my good friend and colleague, Doug Shane, made this modification to his own Long-EZ here at Mojave. He used a Warner electric linear actuator and told me it was rather easy to install and that it worked very well in flight. Being a gadget freak (my wife, Sally, repeatedly tells me I am) I decided I had to have one! I researched the Warner actuator that Doug used and was at the point of ordering one when another friend, Norm Howell, (also a Long-EZ builder) showed up at Mojave with a data sheet on a different electric linear actuator made by Pittman, one that was much smaller and lighter than the Warner. Also, it reportedly could generate more "push" power than the Warner. Norm wanted to order one for himself and offered to include an order for me. I gave him a check and commenced designing the mounting bracketry and hardpoints.

A couple of weeks later, I had the new actuator in my hands and I could not believe how tiny and how light-weight it was. The electric motor was 28 volts which is compatible with N26MS, my Long-EZ. Only one thing disappointed me about it and that was it did not have integral limit switches to shut the motor off at either end of its travel. Doug's actuator did have these limit switches included in the design which would make it easy to install and wire up. Instead of integral limit switches, this Pittman actuator was constructed in such a manner as to limit the total travel to 4" at which point the electric motor continues to run but the actuator stops. This occurs at both ends of the travel.

While this is not an ideal system, it will drive the landing brake down and up with at least 100 lbs. of actuating force and will support at least 225 lbs. while extended and static. This actuator takes about 5 seconds to go from one end to the other of its travel (4").

I first removed the manual landing brake actuating mechanism which included the LB-13 handle, the cables, the LB-1 steel weldment, the LB-21 pushrod and the LB-9 plywood gusset This left the landing brake hinged onto the bottom of the fuselage and the LB-18 brackets remained in place on the landing brake.

The Pittman actuator comes with a 1/4" rod end installed on the end of the actuator and, happily, this rod end fits perfectly in between the two LB-18 brackets mounted on the landing brake. The Pittman actuator fitted without interference through the 1"X2" hole in the floor

throughout the travel of the landing brake. This left me with only having to figure out how to mount the motor end of the actuator to the aft face of the front seat bulkhead.

I elected to cut into the aft face of the front seat bulkhead for installation of the mounting hardpoint because this moves the motor end of the actuator forward partially into the bulkhead allowing a little more baggage room on the floor of the rear cockpit. Working on the aft face of the front seat bulkhead is much harder to do and were I to do it again, I may simply cut into the forward face. I removed glass skin and PVC foam and sanded the inside surface of the forward glass skin before floxing in a rather large solid glass insert (1/4"x3"x5"). After cure, I bevelled the foam and glass and laid up 3 plies of BID over this insert and lapping into the bulkhead. The reason I installed such a large insert is simply crash worthiness. I would not want the actuator to penetrate the front seat bulkhead in the event of an off field landing or crash.

I fabricated two small brackets from 1/8"x1"x1" 2023-T3 aluminum angle, bolted them to the top

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end mount of the actuator, held the landing brake firmly closed and drilled through these brackets and the insert in the bulkhead. After these brackets were installed, I found I had to make a small adjustment at the lower rod end to adequately snub the landing brake in the up and closed position.

I drilled a hole through the front seat bulkhead and ran two 20 gauge wires through this hole over to the left side and forward to the instrument panel. I mounted a momentary-on DPDT, center off switch on the left side of the panel just above the throttle when it is in the full throttle position. I wired the switch through a 3 amp fuse to the 28V buss. The "sense" of the switch is switch handle up, landing brake up. Switch handle down, landing brake down. With this particular installation, the landing brake is extended or retracted in 4-1/2 seconds while static on the ground.

ADVANTAGES. This is an easy retrofit or initial installation requiring only a couple of evenings of work. It is as light, or lighter, installation than the mechanical system. The main advantage in my opinion was that it allowed me to completely remove the LB-9 plywood bracket. This bracket has been the subject of two MAN/GND call-outs in the CP where the concern was that this plywood bracket may penetrate the front seat bulkhead in an off field landing or crash. I was very happy to be able to remove this LB-9 bracket.

DISADVANTAGES. Cost. This electric actuator is not cheap, none of the suitable actuators are cheap. My installation cost me $180.00 not including the cost of the original parts which I removed and discarded. Any electrically actuated mechanism may be more complicated and therefore less reliable than a mechanical mechanism. I don't worry too much about an electrical failure or motor failure because the landing brake is not critical to safe flight.

This change that I have made to my own personal Long-EZ is not a RAF or Burt Rutan approved change. As a gadget freak, I liked the idea so I designed it and made the change myself. If any builder/flyer out there is interested in making a similar modification, send a SASE to me at RAF and I will provide the name and address of the actuator manufacturer. Keep in mind that some manufacturers are very gun-shy of selling you anything that might be used on an airplane so some discretion is required when you purchase one of these.

FLIGHT TEST RESULTS. Testing has shown that the brake can be extended or retracted at any speed below 110 KIAS. Retraction or extension time is approximately 5 seconds. One shortcoming that showed up in flight test was that an appropriate amber warning light is required to warn the pilot anytime the landing brake is not closed. This is a mandatory requirement. I have not flown it often enough at this point to decide if I really prefer it over the manual mechanical system, however, knowing that the LB-9 plywood bracket is no longer installed makes it worth it.

DICK RUTAN FOR CONGRESS

As many of you undoubtedly know, Dick decided to run in the primary election in the 42nd Congressional District, Rancho Cucamonga, CA.. Dick was, in fact, born in this district, and ran against three other candidates for the Republican nomination.

Dick worked very hard, and so did his parents, Mom and Pop Rutan, as well as sister, Nell, and many friends.

Dick won the nomination and is preparing himself for the upcoming General Election in November. He is running against a 30 year veteran and knows this will be a tough battle but, as Dick says, "We need one more fighter pilot and one less lawyer in Congress".

Dick will be a great advocate for general aviation and an enthusiast for the experimental aircraft association

Best of luck, Dick.

Roland Moreau of Canada with his beautiful Long-EZ. **PHOTO OMITTED**

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Back issues	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 73.
VariViggen (2nd Edition), newsletters 18 to 73.
VariEze (1st Edition), newsletters 10 thru 73.
VariEze (2nd Edition), newsletters 16 thru 73.
Long-EZ, newsletters 24 through 73.
Solitaire, newsletters 37 through 73.
Defiant, newsletters 41 through 73.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every effort to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

OSHKOSH 1992

Burt flew the Catbird non-stop from Mojave to Eau Clair, Wisconsin in 6-1/2 hours where he had a business meeting the day before the airshow opened. He had more than enough fuel remaining to have gone on to Oshkosh.

Many builders and flyers noticed that the right canard was missing on the Catbird. This was done to provide more static margin (distance that the center of gravity is from the neutral point) or to improve the longitudinal stability so that the S-TEC auto pilot's "altitude hold" feature would work. The test flight a few weeks before Oshkosh was a complete success. The altitude-hold worked great, so Burt elected to fly it to Oshkosh that way.

Mike and Sally flew N78RA, Burt's Defiant, and transported Burt's friend and attorney, Lee Horton from Mojave to Oshkosh via Chadron, Nebraska. The old Defiant does not get much use these days but it performed flawlessly, there and back. Mike and Sally's Long-EZ, N26MS, which first flew almost 12 years ago in 1980, had been to Oshkosh every year since then. Not wanting to break that string, friends and fellow Scaled employees, Beth and Jeff Holle, flew her to Oshkosh and back to make 1992 the twelfth consecutive Oshkosh. N26MS now has 1980 hours of flight time and still flies great.

During the bull sessions held near the Catbird each afternoon, many interesting subjects were discussed. One subject was brought up that was disturbing. At least three Long-EZ pilots have had their engine mounts crack. Since this is not just an isolated case, all Long-EZ flyers should remove their cowlings and closely examine the engine mounts using a bright light. Pay particular attention to each tube near where it is welded. Anyone finding a cracked or broken engine mount is requested to sent a full report covering number of flight hours, total time in service, nature of the failure and exactly where the failure is located. RAF will keep a file on this subject and will report our findings in future newsletters. If you feel any unusual vibration or hear a different noise, land immediately and carefully check the engine mount.

It is most gratifying to note that even though RAF has essentially been out of business for the past seven years, there were still more RAF designs at Oshkosh this year than any other, just as there has been for the past 10 years.

FIRST VARIEZE BUILDER/FLYER TO MAKE IT ABOARD THE SPACE SHUTTLE

Charlie Precourt, builder and pilot of N81CP, reports that he has over 400 hours on his VariEze with several trips coast-to-coast travelling to speaking engagements for NASA.

Charlie has been picked as a Mission Specialist for the crew of space shuttle, Columbia, when it lifts off the pad at Cape Canaveral in February 1993.

Congratulations, Charlie! How about an article on the shuttle flight for the CP?

RUTAN AND COMPOSITE ENTHUSIASTS 1992 EVENTS SCHEDULE

EVENT: HIGH POINTS AWARDS BANQUET
AND KILO TRIALS.

LOCATION: Montezuma Airpark, Camp Verde, AZ

DATES: NOVEMBER 28 & 29, 1992

ACCOMMODATIONS: Contact: Shirl Dickey

PO Box 4022
Sedona, AZ 86336
602-567-6333

APPROACHING 2000 HOURS

N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots. I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once

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I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.

Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the

design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about

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composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago, have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

LETTERS

"Dear RAF:

This letter finds my aircraft N84GR VariEze up and ready to go anywhere. My years of enjoyment with this fine design are pleasant memories which nothing can replace.

I use my aircraft mostly for cross country flights. I rarely get into weather, but have the quals and gages if necessary. I find that 11,500 ft. is max when wet. Rain during takeoff always means an extra 500' roll before lift off. My stall when wet is 10 knots faster than dry....so I advise everyone to watch the wet stuff. Here in Florida we get our share of liquid sunshine. Always watch out for puddles on the runway....can pull you off runway and ruin your whole day (like my friend Byron McKean's previous report).

My only hangertale concerns a flight I took this last summer. I normally fly from Pensacola to Stuart, Florida to visit my family several times per year. It is such a routine flight now, I know the route by memory. I usually fly the VFR corridor just south of Eglin AFB along the beautiful white beaches to Panama City then direct to an intersection just west of Cross City and direct to Orlando...direct Stuart. The flight normally takes 3+00. I was at 9,500' just south of Orlando and waiting for a few more miles closer before beginning my enroute descent (35km) into Stuart when my trusty 0-200 seemed to change pitch and lose some power. I began checking into things not worried too much since I had over 750 hours on that engine and had only 100 plus hours before done a cermichrome overhaul on the top end. Mags checked okay....tank change did not help....(I have the Long-EZ fuel system with separate main tanks plus the emergency)....the emergency tank did not help....(I knew of one guy that had a clogging fuel filter and the higher point of the emergency tank gave more head pressure through the filter....plus RAF reports say the same)....boost pump was okay....oil pressure fine....so I backed the throttle a bit....then she began getting rougher....NO GOOD! I hit emergency search on the loran....(A nice feature to have even if you know your way) figured I best be getting on the ground asap....(I really wanted to go that next 80 miles to Stuart, but knew better....ole Navy flight training and common sense said..."Get it on the ground while she is still running") so....I landed at Sebastian (home of Danny Mayer and Velocity). A nice twin allowed me to have his place in the pattern after I said I had a rough runner. I landed a bit hot (lots of runway) with plenty of altitude in case of failure, but she was running fine at idle...no oil to be seen, so I taxied in to give her a good look-see. After a lot of looking and plenty of advice from Danny and other local folks the problem could not be immediately found. New fuel, plugs, etc...did not help. The next day with the help of my cousin Tim and friend George of Aviation Propellers, Miami we found a loose exhaust valve guide on number two cylinder. The keepers were still in and springs working fine. This allowed the engine to run fairly well at idle, but at high rpm the valve was floating some and causing loss of power. (2200 rpm static) Lucky for me the keepers stayed in and no significant damage was done. A new cylinder was shipped out (complete warranty replacement by cermichrome folks and my mechanic Don Freeman, Aviation Engines of Hueytown, Ala..thanks!). My cousin and friend drove up from Miami again and helped me put her together...I mostly watched...then after a short test flight returned to Pensacola....nonstop. This once again reminds us to believe what we have and don't push it. With only one engine back there and God only issuing each one of us one sweet life it is the prudent man/lady who is careful while hurling themselves through the air at tremendous velocities.

That's about it for now. Ken Forrest's old VariEze N84ST is well over 1000 hours now and still flying fine in the hands of my hangermate.

Just a thought, I and many others are still awaiting a new 3-4 place bird from Burt which will run the pants off the competition....please.

Together for a GREAT AMERICA
Ralph Gaither"

"Dear RAF,

I'm writing this letter in the interest of safety for all canard-pusher type designs. Please feel free to edit or paraphrase it at will; I just want to help others avoid the scare that I had.

As a little background, I bought my Long-EZ about two and a half years ago with 400 hours on the airframe. Since then, I have put almost 300 more hours on it, including a trip around the borders of the US last summer. I love my plane, but my only regret is that I did not have the honor of building her myself.

Last week, after doing an oil change, I took off into a quiet Friday evening sky at my home field for a test flight. I climbed to 8,000 feet, where I spent about 15 minutes watching the sun set, after which I started my descent.

Suddenly, there was a loud bang, followed by violent vibrations. I immediately pulled the throttle to idle and shut off the mags as I pulled the nose up. The prop stopped quickly, and I was able to see in my rear-view mirror (a small convex mirror inside the canopy for looking at my passenger) that something had hit my B&T prop and that it was badly broken.

I decided to keep the engine off and glide back to my home field. Fortunately, I was at about 5,000 feet and only 10 miles from my airstrip, a mile-long asphalt runway. This would have been possible in any plane, but was an easy task in the Long-EZ with its great engine-out performance. I announced my problem on unicom and the FBO operator monitored my descent.

As I touched down on the runway, I was amazed as to how dark it was, for I'd forgotten that sunset at 8,000 feet occurs quite a while after it had on the ground at sea level. I rolled out without any problems and got out to inspect the damage and determine the cause.

It was immediately obvious that my right exhaust stack had broken inside the heat muff box and that was what had damaged my propeller. The damage to the prop consisted of complete loss of the plastic rain edge, a gouge out of the leading edge of the blade measuring about 1 inch by six long, and a 5 inch longitudinal crack propagating from the impact point towards the hub.

After pulling the cowlings and exhaust stack, I was able to determine that the cause of the problem had been entirely the result of the builder NOT FOLLOWING THE PLANS and my A&P mechanic and I missing a problem in the recent annual inspection (5.5 flight hours prior). The

heat muff and been built as per the plans except that it had not been welded directly to the exhaust stack. Instead, it had been built to be a snug fit. The problem with this was that this design allowed it to vibrate, albeit in very small movements, and this slowly ground away at the wall of the exhaust stack. The groove was deepest on the inside wall of the muff. After almost 700 hours of use, the walls of the stack were paper thin and finally gave way, allowing a half-foot long section of the exhaust stack to separate and hit my prop.

Believe it nor not, this failure may have saved me from an even greater danger - that posed by carbon monoxide poisoning from exhaust gases leaking into my cabin air system.

Lessons learned:

1. With the engine off, I'm glad I have a Long-EZ, as she has a great glide ratio and handles like a dream.
2. I was glad that I had practiced simulated engine failures just the flight before; the practice really helps out.
3. Build your planes as per the plans. If you do buy a used RAF design, go over each and every step in the plans (which should be included as a condition of sale) to find where an error or oversight might have occurred.
4. Pay special attention to the dangers of very small vibrations; small movements over long periods of time can grind through very strong metals.

I hope that this information is of help. If there are any of you out there thinking of buying a used EZ, please call me. The designs are great, but, as experience has taught me, used homebuilts have an unusual number and kinds of pitfalls.

Have a great day flying, and thanks to the folks at RAF for their continuing support.

Sincerely,
Tom Staggs"

"Dear Mike:

Several weeks ago, I had a right brake failure on landing. Please re-alert others as to the serious nature of a brake failure, and suggest they frequently inspect their brakes. Finally, I

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suggest there may be a problem with Silicone brake fluid (DOT 5 motor vehicle standard #116).

In the last 2 months, I have flown around 200 hours, and the brakes had been working fine. (Yes, the brakes were inspected twice during this period). The takeoff at MEI, prior to the problem landing, the right brake was nearly gone. Previous flight, only 1 hour before, indicated no problem. I aborted the takeoff to bleed the brake. This seemed to fix the problem and I left with excellent brakes. However, two hours later I landed at RKW with NO right brake.

Assuming I might still have a problem, I landed with the wind on the right side. This worked great down to about 30 knots when it was obvious the nose had to be lowered to stop (I should have cut the engine on landing!). The damage was minor (retract gear and a few scratches) but could have been very serious. For example, had I landed the other direction, I would have left the runway at a much higher speed and went into the trees. The pilot has little control of a Long-EZ without brakes. It's a very sobering, dangerous situation -- best avoided!

I inspected the brakes after the accident, and found three confusing things. The calipers and pads had retracted about 1/4" from the disk. Why? The pads, disk and wheel pant were covered with silicone brake fluid. A leak (but small??) was found in the tube where it connected to the caliper. I believe the leak was initiated by 7 years of age and a "hot" landing several weeks before at a high altitude airport. Finally, there was a "gummy" gray deposit on the O-rings within the tubing and elsewhere. This indicates stability/compatibility/moisture problem with Silicone Fluid. I have changed back to standard good old red aviation fluid. Its thicker, lubricates better, works and leaks are apparent! I had changed to silicon fluid about three years ago after reading about it in a CP.

Mike, I have over 1300 hours in Long-EZ's and I have never had as serious a problem as this. I spend more time inspecting/working on my airplane than flying it! For example, in the last 7 years, I have replaced both master cylinders, upgraded to 50-106 disks and completely dissembled, cleaned and inspected the brake system 3 times. Yet, it got me! I will be even more attentive to the brake system!
Tim Crawford"

Editor's note: We have used silicon brake fluid (Dot 5) in all RAF airplanes for many years, the main reason was aircraft red brake fluid is highly flammable, Dot 5 is not. This is the first problem we have had reported. Mike did replace the o-rings in his master cylinders about 6 months ago and found a "grey" deposit in each cylinder. This was cleaned out and the brakes have functioned perfectly ever since. Has anyone else seen any problems using Dot 5 silicone brake fluid?

Keep those letters coming! Remember, anything that was a problem, or of interest to you, will also be appreciated by other EZ people.

FROM "GENERAL AVIATION AIRWORTHINESS ALERT" FAA AC 43-16

LONG/VARIEZE - LANDING LIGHTS

Some owners/builders of the Long/VariEze are relocating the landing lights from under the fuselage to a position outboard in an attempt to

improve lighting for night landings. Several instances have shown where the builders have created a separate cell in the fuel strake for the landing light.

The submitter of the Malfunction or Defect Report stated that this is a poor choice for a device that generates so much heat. Even without a fuel leak, the amount of heat generated by these lights in such close proximity to 26 gallons of fuel is very risky. If a short circuit should develop and the fuse or circuit breaker fails to trip, the short could cause sufficient heat to melt the resin and dissolve the foam that seals the tank causing a fuel leak into the light housing. A fuel leak from a simple bulkhead seam flaw could also cause ignition simply from the heat of the light.

High amperage circuits and heavy amperage consumers should never be placed in or around fuel lines or storage cells.

CAUTION

Corrosion in the gascolator sediment bowl and even in the aluminum fuel lines is not only possible but has occurred more than once. Check you gascolator bowl often and, if ever you smell gasoline in the cockpit, do a thorough inspection of all aluminum fuel lines for leaks at the "B" nut fittings as well as leaks in the lines themselves due to corrosion.

OVER-VOLTAGE PROTECTION

Most modern homebuilts today have very expensive avionics in the panel, yet few have protection from a run-away alternator. Don't think this never happens - we have reports from two builders since last CP! The cause can be as simple as a loose or badly corroded connection on the "field" nut on the alternator. The result can be the total loss of such items as radios, transponders, lorans, intercoms, even Bose headsets!

A simple fix is to use one of Bill Bainbridge's linear voltage regulators with built-in over-voltage protection. Don't risk your expensive avionics - install some form of over-voltage protection before you fly again. A truly excellent source of information on things electrical is Bob Nuckoll's AeroElectric Connection.
Contact at: 6936 Bainbridge Road
Wichita, Kansas 67226-1008
316-685-8617

The service is offered by subscription; back issues are available and strongly recommended. The major effort now is to write and illustrate a book. Work in print right now totals about 200 pages with lots of illustrations. Chapters presently cover:

1 D.C. Fundamentals
2 Batteries
3 Engine Driven Power Sources
4 Voltage Regulators
5 Grounding
6 Over Voltage Protection
7 Electrical System Instrumentation
8 Wire Selection & Installation
9 Wire Termination & Connectors

10	Circuit Protection
11	Switches, Relays & Contactors
12	Lighting & Lighting Controls
13	Antennas and Feedlines
Appendix A	List of Supplies for New & Surplus Parts
Appendix H	Collection of Hot Flash Newsletters
Appendix K	Collection of Do-it-yourself Avionics projects
Appendix Z	Power Distribution Diagrams (Big Foldouts)

Future chapters will cover noise and interference, motors and controls, audio/intercom systems, ignition systems, system reliability, pilot workload reducers, electrical load analysis, failure mode effects analysis, and how to develop a customized wire-book for your airplane. Appendix K will continue to grow. Planned projects include an audio/intercom system, hall effect battery ammeter, an accurate, used calibrated fuel gaging system, expanded scale voltmeter, and many more. Appendix D is being planned to carry excerpts from various manufacturers' catalogs with detailed information on components and supplies. Appendix S will outline custom design, fabrication and documentation services to be available soon. Issues consisting of chapters to the book are supplemented by Hot Flashes from the

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AeroElectric Connection: a newsletter which addresses timely topics and carries errata information for the book.

The service will shift to quarterly newsletter when the book is finished. Newsletters will carry regular features in addition to timely topics and error corrections. A planned feature is a "Catalog Watch" column where items for sale and of interest to readers will be listed. We'll carry articles from readers on discoveries or ideas they wish to share. The newsletters will provide a vehicle for periodic updates, sometimes complete replacement of chapters in the book as new technology or information dictates.

Subscriptions are $10.00 per issue. Back issues should be ordered and they are always available. Issues #1 through #4 may be purchased as a group for $32.00. Subscriptions for other than USA or Canada should include $4.00 per issue for first class, air mail postage. Book material has been planned for at least 7 issues. The Connection is published in three-ring, loose leaf binder format; a "living" work that will be updated as technology advances and/or new information is found. From time to time, Hot Flashes will be mailed to subscribers when an important subject must be addressed between regular issues of the Connection

ACCIDENTS AND INCIDENTS

"Dear Mike,

On May 20, while doing touch-and-go's at Clark Co. airport in southern Indiana, my VariEze (N64SJ) was extensively damaged. I had elected to go around because of a slower aircraft ahead (C-150). While traveling along the right side of the active about half throttle in a very

shallow climb, just past the take-off end of the runway, I moved the throttle to full power. The engine (0-200) started to respond then tailed off to nothing. I turned back toward the airport but came up about 50 yards short of the intersecting runway. It had rained quite heavily for several days previously and the sod was very soft.

The aircraft rolled several yards before the nose gear failed causing the plane to flip forward landing inverted and traveling another few yards before finally coming to rest, tail first, upside down.

Damage included -- Right wing broken just o/b of the wing attach fitting, left wing broken at mid span, Canard separated from aircraft taking a small part of F-22 bulkhead, the elevator control pushrod did considerable damage to the right side of forward fuselage before it finally broke, the canard has a small tension tear in the top skin at mid span, the main gear has some torsional damage, both winglets were broken near mid span, the taper pin holes in the top sides of both inboard sections of the wing attach fitting were slightly elongated from tension, other damage to canopy and cowling that I won't go into here.

After removing the cowling, the cause of the engine stoppage was obvious. The aeroduct between the carb heat valve and the carb had collapsed. A further check confirmed that both ends of the coiled wire were held tightly under the worm clamps. The wire coil had become completely disorganized and, in fact, parts of it looked somewhat like a Slinky that had been mistreated.

On a subsequent engine run, the engine repeated the in-flight shutdown. After removing the aeroduct, the engine ran normally.

I feel the shoulder harness and seatbelt and rollover structure worked very well as I was uninjured.

I can't say how much I enjoyed and miss my EZ. I would appreciate any advice you might have about possibly rebuilding.

Please pass on my experience with the aeroduct,

Best regards,
James Bierly"

CP73, Page 9

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

MANDATORY GROUND

VARIEZE AND LONG-EZ
Engine mount weldment inspection before next flight is required. Using a bright light, carefully examine the tubing close to each weld in the entire weldment. Look for hairline fractures or cracks. See page 1, this CP. Please report any cracking or failures found to RAF. If at any time during flight you should feel any unusual vibration, land and check the engine mount for cracks.

ALL RAF DESIGNS - See Accidents and Incidents this CP, page 9 - aeroduct collapse.

Carefully check any aeroduct hose in inlet systems for security and condition. Suspect hose must be replaced before next flight

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Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

FOR SALE

FLUSH RUDDER BELHORN SPRINGS.

Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049

NOSE GEAR RATCHET

Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 pp. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it. Contact:

Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES

New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $30.00 per set.

Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

The "Bead Buster" TM - $75.00.

If you have ever tried to remove a tire from a 500x5 wheel you will understand what a neat tool this is. Designed by a Long-EZ builder who became frustrated by this problem, the kit consists of a canvas pouch, a vulcanizing patch kit, cadmium plated fulcrum lever and base, and the heat treated aluminum "Bead Busting" shoe.
Contact: Tom Caughlin
10958 National Blvd. #1
Los Angeles, CA 90064

Custom cover for your Long-EZ. This neat design completely covers your prop, canopy and nose and only uses two straps. Made from space-age Evolution 3 material. Reasonable price.
Contact: Tony Brazier
PO Box 6478
Ocala, FL 32678
904-237-1811

AIRWOLF FILTER CORP.

After 4 years of design and testing, Airwolf Filter Corp. is proud to release to the homebuilt market their Lycoming remote mount oil filter. This remote mount filter was designed to replace the 4-bolt Lycoming P/N 69510, 68974, or 62815 oil screen housing at the rear of most Lycoming 0-235, 290, 320, 340, 360, 540, and 720 series engines. This adapter allows the user to locate the oil filter to the firewall and is a welcome relief since many Lycoming engine applications are unable to use the current spin-on adapters due to space restrictions. In addition this kit, including the oil filter, adds less than 4 pounds to the aircraft empty weight.

The AFC remote mount oil filter kit is available in three versions. 1) The basic kit includes only the oil filter adapter and remote oil filter mounting plate and retails for $495.00. 2) The deluxe kit includes the oil filter adapter, remote oil filter mounting plate, spin-on oil filter, Aeroquip steel braided hose and fittings, AN-8 fitting and bulkhead nuts, Vitron O-rings, Teflon washers and is priced at $695.00. 3) Remote filter adapter (allowing the homebuilder to use his own oil filter mounting base) for $395.00.

The entire remote mount filter installation should take only 1 to 2 hours to install in most applications.

The public release of this product will be at Oshkosh 1992 and our booth is 368E in the Fly Market.
Contact: Airwolf Filter Corp.
15401 Madison Road
Middlefield, OH 44062
216-632-5136

Kevlar Long-EZ cowling (new)	$380.00
Wheel pants for 500x5 (new)	140.00
Carb heat box (new)	50.00

Carburetor MA4SPA 400.00

Contact: John Perry
619-721-5937

Lycoming 0-235-L2C - 2000 hrs... TTSN. Removed from a flying Long-EZ, mags, ignition harness and carb included. $5500.00.
Contact: Steve Bowser
707-629-3445

King KX-145, 720 channel Nav-Com $550.00
EZE nose gear ratchet assembly 25.00
Contact: Dan Worley
818-366-8803

Edo Aire Rt-553 Com/VOR radio with integral CDI in a single panel unit 6.5" (wide) by 3.25" (high) by 12" (deep). Excellent condition, replaced by a Loran. Complete with all documentation for installation. $475.00
Contact: Sam V. Shelton
145 15th Street #1221
Atlanta, GA
404-894-3289

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1 Long-EZ main gear strut $280.00
1 Long-EZ nose gear strut 45.00
5 pieces blue foam for wings 7' long
(you pick up)
Contact: Jess DeLaCueva
818-918-8047

WANTED

Great American multi-laminate prop for 0-235-L2C powered Long-EZ. 62x62. Must be in good condition.
Contact: Frank Nowak
Searle Road
Huntington, MA 01050
413-667-5595

Antenna Dynamics ADL-3 or ADL-4 hidden Loran-C antenna.
Contact: William J. Norton
9197 Lime Ave.
California City, CA 93505
619-373-1323

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now it its 2nd Edition. (For a complete description, see CP57). Includes all builder related information from CPs 24-72. The 2nd edition of the Digest has now grown to over 700 pages, and is professionally printed on double sided 8 1/2 x 11" paper from a laser printed master.

Quarterly updates to the Digest are also available. The updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

Note that the Digest is builders and flyers of the Long-EZ only. It does not support other RAF designs.

CP Digest for the Long-EZ (2nd Edition) $75.00
(Overseas orders add $20.00 for airmail
Annual Update Subscription (4 updates) $25.00
Overseas orders add $5.00 for airmail

CANARD PUSHER NEWSLETTERS "ON DISK"
Stet Elliott has also compiled the text of all the Canard Pusher newsletters in electronic format. The set includes all of the Canard Pusher Newsletters, from the very first one published in May of 1974, to the present. The set of CP's is provided in a text only format which should be 100% compatible with any computer word processor you presently use. It is available for either the IBM or Macintosh platforms. A hard disk is strongly recommended since the set contains over five megabytes of textual information!

This product is ideal for anyone interested in reading about the evolutionary development of RAF's canard designs through the years, or for those builders still plagued with the "I know I read it here somewhere!!" syndrome. With one of the inexpensive text search and retrieval programs, text string searches across the entire set of files are a snap.

CPs on disk costs $65.00. Specify disk size, (3 1/2" or 5 1/4"), platform (IBM or Mac), and disk capacity.

For either the CP Digest for the Long-EZ, or the CP's on disk, contact:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-4156

VARIEZE INDEX

Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file). Specify which you would want, for $24.00. This index will be updated annually.

Contact: Bill Greer
8827 Larchwood Dr.
Dallas, TX 75238
214-348-0215

PLEASE NOTE: Those of you who have the first edition, Bill has improved the indexing of several topics and added more cross-indexing You may find it helpful to get an up-grade.

DEFIANT FLYER

If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's letter on his Ford-powered Defiant in the December issue is a case in point. See CP67, page 2 for information on subscribing to the Defiant Flyer.

Seen at Oshkosh. Beautiful leather seat cushions (also available in various fabrics) for Long-EZ, VariEze and Defiant.
Contact: Diana Davidson
Alexander Aeroplane Co.
900 S. Pine Hill Road
PO Box 909
Griffin, GA 30224
404-228-3901

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/ bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00

FEATHER LITE PRODUCTS

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel.
$40.00
Contact: Larry Lombard or
Mike Dilley at
Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:
Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received several enthusiastic letters of recommendation for these props. See their ad in Sport Aviation.

CP73, Page 13

Charlie Precourt, builder and flyer of VariEze, N81CP, has been chosen to fly in the space shuttle next February. The first EZ builder/pilot to achieve this honor. Congratulations, Charlie! **PHOTO OMITTED**

CP73, Page 14

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THE CANARD PUSHER No. 74 Jan 93

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Back issues	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 74.
VariViggen (2nd Edition), newsletters 18 to 74.
VariEze (1st Edition), newsletters 10 thru 74.
VariEze (2nd Edition), newsletters 16 thru 74.
Long-EZ, newsletters 24 through 74
Solitaire, newsletters 37 through 74.
Defiant, newsletters 41 through 74.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every effort to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.
SOMETHING NEW HAS BEEN ADDED

The post office has decreed that a change be made to our address. The flight line number must appear above the city name or they will not deliver our mail beginning March 1, 1993.
Please read and heed.

OSHKOSH 1993

Note new start date. This year, Oshkosh 1993 will start on Thursday, July 29th and will end on Wednesday, August 4th.

For several years now, the fly-in has started on Friday. Most people, of course, arrive on Thursday. We suppose most people, including us, will now arrive on Wednesday!

Burt's talks this year will be tentatively on Friday, July 30th; Saturday, July 31st; and Sunday, August 1st. All of these will start at 10:00am. Design College will start at 8:30am on Saturday, July 31st.

LETTERS

"Dear RAF;

Thought that you might be interested in knowing some of the details of another world record set by a Long-EZ during my flight to 30,500 ft. in N121DT. The flight has yet to be certified by FAI and NAA, however I see no problems at this time. After altimeter errors are computed in, expect to be certified to 30,370. (Editor's note: Verification from NAA has been received since this letter arrived at RAF).

My Long-EZ, fully equipped including oil, weighs 889 lbs. having no starter. Class C.1.a. has a max take off weight of 1102 lbs. including instrumentation to certify the flight. Needless to say, with fuel, added instrumentation and me at 175 lbs the aircraft would be about 50 lbs. over weight.

To make the flight, I removed the back seat upholstery, navigational lighting, wing-leveller autopilot, fire extinguisher, ELT, alternator, all radios, prop spinner, oil cooler, carb heat muff and 15 lbs. of body weight. Had to eat a lot of

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popcorn without beer to wash it down to bring my body weight down to 160 lbs. On a previous test flight I discovered that the vacuum pump still pulled almost 3 inches at 25,000 ft. so I elected to keep my vacuum pump and gyro instruments in case the inside of my canopy frosted over, which it did partly.

I added an electronic ignition made by Electroair and removed the right mag to give me advanced timing and performance at altitude which worked flawlessly. I also had a climb prop (70Dx46P) made by Performance Propellers for my Lycoming 0-290. The prop turned 2800 RPM on climb out and 2600 RPM at 30,000 ft. For communications with ATC and the ground during the flight, I fabricated a microphone into my oxygen mask and carried a hand held radio.

Weigh-in was 1099 lbs with 10.5 gallons of fuel, 8 gallons in the right tank for climb and 2.5 in the left for return flight. I also carried a video camera mounted over my right shoulder and a recording barograph in place of the back seat.

Take off from Camarillo airport was at 08:15 Dec. 5, 1992 with an initial climb rate of 2300 ft./min. ATC had been FAXed of my intentions for airspace more than 12 miles off the coast of California. So when I was handed off to LA Center they were expecting me and

cooperated to keep me out of the Continental Control Area before climbing above FL180 VFR, as well as recording my mode C replies for the record. Interestingly, at 29,000, ATC asked if I was turbo charged!

Passing through 20,000 ft. I was climbing at 700 ft./min. However, it took me a couple of minutes to make the last 100 ft. to 30,500 indicated. I had reached my goal of breaking 30,000 so at 1 hour and 4 minutes into the flight, I leveled off and held that altitude for another three minutes The engine was turning 2600 RPM at approximately 8.5 inches of manifold pressure and I figured that I was developing about 30% power. Outside air temp. was -40C and my hands and feet were getting cold through my gloves, layers of clothes and snow boots.

Descent and return to CMA was uneventful. I found a warm reception waiting for me with Dick Freeborg, the National Aeronautic Association and FAI representative, the first one to shake my hand.

Note worthy is that this altitude record breaks the previous of record of 27,040 ft. set two years ago by Hoot Gibson, astronaut and space shuttle commander, in a modified Cassutt.

Dave Timms"

Ed. note: Hoot Gibson took his record away from Norm Howell, Quickie and Long-EZ builder, flying Terry Schubert's Long-EZ.

"Dear RAF;

At the Long-EZ's annual this spring, I made some changes which caused me a lot of misery. Relating them might help someone else who might contact you with a similar problem. I decided to install a starter (lightweight), which I had never had before. After installing my new starter switch with the start position, my engine would not run on the right mag unless the right grounding wire was disconnected. I traced wires. I ohm-ed out wires. I replaced wires. I changed starter switches. I installed new series 4300 Slick mags as my 4100 series mags had 500 hours on them and were 14 years old. The mags would operate normally when the switch was hooked up but not installed in the panel, but the right mag would cut out when the switch was installed. I replaced the capacitor in the new right mag. Finally, my friend Frank Caldeiro figured out that the right mag lug on the switch was grounding on my radio stack tray just above the switch. Once the switch was insulated from the radio tray, the mags worked fine. Incidentally, Chief Aircraft who sold me the mags said that Lycoming recommended the 4370 right mag and the 4372 left mag for the O-235-L2C. The 4372 has only 15 degrees of lag when cranking the engine which gives ignition at 5 degrees BTDC when you set the timing at the 20 degrees BTDC called for on the engine's data plate. My old 4100 series left mag had about 25 degrees of lag which gave me spark at 5 degrees ATDC. Tomahawks (L2C) and 152's (L2A) have had a reputation for hard starting. My L2C starts much better now than it ever did, either hand propping or cranking. I highly recommend the 15 degree lag for the left mags on 0-235-L's.

Best wishes,

Fred I. Mahan"

BRUCE TIFFT, PROP MAKER

We first met Bruce and his wife, Bonnie, in 1979 at Mojave. He had brought up one of his props for Burt to test on the prototype VariEze, N4EZ. Bruce was a gyrocopter builder/pilot and had been building gyrocopter props for some time. He had started building a VariEze and was thinking of manufacturing props for the speedy pusher to help offset the cost of building his own example. It did take a couple of iterations to get the prop to work but Bruce persisted, and today, B&T Props builds lots of props each year, most of them for VariEzes and Long-Ezs with a few RVs Defiants and Glasairs thrown in.

Bruce and Bonnie lived in Ventura, California where B&T Props began. Their yellow VariEze was hangared and operated out of Santa Paula airport. Sadly, after some 700 hours of flying, an accident destroyed their VariEze at the Santa Paula airport (Bruce was not flying). Not having this swift method of visiting airshows and delivering finished props to their customers put a serious crimp in their lifestyle and their business. They resolved to build another VariEze. Meanwhile, the Long-EZ had come along. When Bruce got the opportunity to buy a partially built VariEze, he decided to combine the attributes of both aircraft. The result is their beautiful "Vari-Long", a highly modified VariEze with Long-EZ wings and winglets. A one-of-a-kind aircraft that embodies all of the remarkable skills of the quiet, unassuming prop maker, Bruce Tifft.

When we visited Bruce and Bonnie in Oregon at their neat little "Bend in the Creek Ranch", just outside Cottage Grove, Bruce very kindly demonstrated what goes into building a prop from start to finish.

First, and most important, he must have good raw material. Bruce lucked out here. It turns out that there is a lumber yard in Eugene, Oregon that willingly obtains, and keeps in stock just for him, premium grade, straight grain, Canadian Hardrock Maple. Not only that, but they plane it to the thickness and smoothness he requires, in lengths that he can use.

He starts off by trimming the ends of each board on his cross-cut saw to get rid of any cracks that sometimes occur in the extreme ends of these boards. He then cuts the board into appropriate lengths, depending on what prop he plans on building. It takes six boards laminated together to provide the blank from which he carves the propeller. The six boards are stacked neatly and he drills a small hole at each end. The holes will accommodate steel pins which locate the boards relative to each other while they are in the press during the glueing cycle. Glue is then hand rolled onto each surface of each board. They are then stacked back together and pinned to prevent slippage. This stack of maple is then placed in a special hydraulic press which Bruce designed and built himself. This press can accommodate up to three prop blanks. Each is separated by plastic film to prevent the blanks from sticking to each other. The nine hydraulic jacks are then slowly tightened, in sequence, until an enormous force

is uniformly applied to the wet glued blanks. An amazing mount of glue squeezes out from between the boards as they are left to cure for at least 48 hours.

The cured blank is then cut square at each end and, using an appropriate template or pattern, Bruce marks the blank. Using a band saw, he removes material to arrive at a rough planform of the prop, as well as to come somewhere close to the shape of each blade. Bruce has literally dozens of patterns derived over the years that help him to produce his consistently excellent props.

Next, he lays out and drills "center" holes in each end of the blank and installs it in his wood-turning lathe which has been highly modified to trace a "master" propeller. This "master" is installed between centers about 2 feet behind the lathe and is driven by a chain and sprockets at the same RPM as the lathe. A large aluminum wheel traces the master and, in turn, drives a powerful circular saw in and out of the new blank. The lathe's automatic-feed moves this carbide saw from the tip of one prop blade, through the prop hub, and all the way to the tip of the other blade. It takes one roughing cut which removes one to one-and-a-half inches of wood and glue, and one finishing cut to complete the automatic tracer lathe part of this job. This machine is located in a small building behind the

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farm house and while it is running, you must wear hearing protection. The noise has to be experienced to be believed!

The "prop" is now ready for the extensive hand finishing that Bruce puts into his product. The carbide circular saw leaves a line across the blades and around the hub which Bruce sands off using various power sanders, as well as hand-held sanding blocks and sand paper. The trick is to sand only until these lines just disappear, and no more, otherwise the prop will not be exactly the same as the "master".

Prior to this sanding operation, Bruce drills the center hole through the prop; the counter bore that locates the prop on the prop extension; the six prop bolt holes and the counter bores for the drive lugs - using heavy steel drill fixtures designed and custom built for this job.

We could see that it would be very easy to ruin a prop at this point since a pusher prop and a tractor prop must have the counter bores on opposite faces!

Once the prop has been hand sanded to the required finish and balanced, Bruce uses a router to remove about 1/4" from the leading edge of each blade. He then casts a urethane leading edge in place, using a proprietary system that he developed (B&T Props pioneered the urethane "rain" leading edge since copied in some form or other by nearly all of today's prop makers). A sanding sealer, followed by many coats of clear Imron is carefully sprayed on while the balance is checked between each coat. Once fully dry, the B&T decals are installed and the prop is shipped to the customer.

Bruce and Bonnie have shipped their beautiful propellers all over the world during the past 14 years and there are hundreds of EZs (as well as many other homebuilt designs) currently being propelled by Bruce's craftsmanship. Bruce has had the advantage of first having his own VariEze and then his own Long-EZ on which to develop and test his props. One of the other very nice services Bruce offers is a repair/refinish for any wood prop. Also, as many of you know, Bruce can usually provide a "loaner" in the event of a damaged prop. Recently, with the demise of Great American Props, Bruce has been literally swamped with prop orders and has been having to try to complete his props on an "as required" schedule instead of a "when ordered" schedule. He asks that you have patience and that you let him know, as accurately as you can, when you will actually be needing your prop so that he can satisfy the builders who are ready to fly in a timely manner.

If you are in need of a wood prop for your project, give Bruce a call or drop him and Bonnie a line. They are neat people and Bruce knows more about fitting the right prop to EZs, regardless of what engine they have, than anyone else we know.

Contact: B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

SAFETY-POXY SAFETY BULLETIN

The Occupational Safety and Health Administration (OSHA) has issued a ruling on exposure to 4,4'-methylene Dianilen (MDA). This ruling was published as 29 CFR (Code of Federal Regulations) and 1910.1050 (Applicable to General Industry). MDA is contained in Hexcel's product, Safety-Poxy Hardner (2183 or 2184) in sufficient quantities to be toxic to the human liver as well as being suspect as a human carcinogen.

To obtain copies of the appropriate standard from OSHA's national office, call 202-523-9667, or obtain from any regional or area OSHA office.

Fully cured articles made with MDA are exempt from this regulation.

Based on all of the information available to Scaled Composites, it is our opinion that all but a very few manufacturers will find the requirements for safe use of products containing MDA to be so restrictive and expensive as to necessitate the replacement of these products with alternative materials containing no MDA but which serve essentially the same function.

To this end, Scaled Composites has recently tested more than 70 possible alternate epoxies

and has found at least one which satisfies all structural, pot life and wet-out characteristics. Fuel compatibility tests are now in process. It contains no MDA and all chemicals incorporated in it meet, or exceed, current OSHA requirements for safe use. The resin is PR2032 and the hardener is PH3660-2. The mix ratio is 100 parts resin to 27 parts (by weight) hardener. By volume, the mix ratio is 3.2 to 1 (resin to hardener). As you will all be aware, this is not the same as Safety Poxy which is 100 parts resin to 44 parts hardener. Michael's Engineering is working on a method to convert your current Safety Poxy ratio pump to correctly ratio the new epoxy. Send a SASE to RAF for a copy of this simple conversion.

In order to be able to mix this new epoxy using your ratio balance, you should re-configure your ratio balance to place the hardener cup at 3.7 inches from the pivot (dimension B) and the resin cup at 13.7 inches from the pivot (dimension A). This will give an accurate 100:27 ratio, by weight.

Our suppliers, Aircraft Spruce and Wicks, are presently proceeding to stock this material.

Our safety regulations for use at Scaled allow us to continue to use our remaining supply of 2410/2183 provided satisfactory precautions on skin contact are used. Refer to OSHA's MDA standard for further information.

MARVEL METAL FLOATS

Terry Schubert reports difficulty getting a new metal float to work correctly. It turns out that the tooling to manufacture these carburetor float bowls is very old and no two bowls are, in fact, identical, therefore, no one float will fit all bowls! Terry got a lot of help from Bill Smith of Consolidated Fuel Systems and highly recommends talking to Bill if you are having trouble in this area. Phone: 205-286-8551

ENGINE MOUNT CRACKING (UPDATE)

Only one report has come in regarding a cracked engine mount. This one was a conical Lycoming mount. After 530 hours, the tube from the lower right engine mount bolt hole was found cracked completely through about 1" above the bolt. This was repaired by welding a sleeve around this fracture. The prop was dynamically balanced and there has been no further sign of a problem with 807 hours now. The vibration is noticeably less and an exhaust flange cracking problem has also been solved.

We have been talking to anyone we can regarding this engine mount cracking problem. We spoke with one very experienced builder/flyer who had a tube crack through on a Dynafocal engine mount. The fracture occurred about 1/4" from the weld between the tube and the right upper Lord mount cup. This kind of crack is usually caused by improper normalizing of a TIG welded 4130 weldment. There is simply not enough evidence at this time to point at whether this may be a design problem or a heat-treat problem.

Anyone who finds a crack or fracture in an engine mount, please report it to us here at RAF. In the meantime, a close inspection of you engine mount, using a strong light, every 25 hours is recommended. Any unusual vibration felt in flight is cause to land and check the mount. On the bright side, there are now dozens of VariEzes and Long-Ezs with accumulated flight times of more than 2000 hours with no engine mount problems whatever. Please do contact RAF if you hear of, or experience a problem like these.

AEROQUIP SERVICE BULLETIN

TO OWNERS/OPERATORS OF ALL GENERAL AVIATION AIRCRAFT USING AVIATION GASOLINES (E.G., INCLUDING, BUT NOT LIMITED TO, 100 OCTANE LOW LEAD, HIGH OCTANE AUTOMOTIVE UNLEADED, ETC., HEREINAFTER REFERRED TO AS "AVIATION GASOLINE").

Aeroquip Corporation's Aerospace Group has recorded several failures of its 601-type hose over the past 12-month period. The subject hose meets all required specifications, however, based upon data accumulated to date, it appears that the use of this hose in fuel systems which carry AVIATION GASOLINE is adversely affecting the life expectancy and performance which Aeroquip has historically experienced with this type of hose.

Aeroquip has seen degradation of the elastomeric inner tube which has resulted in the tube cracking which, in turn, has caused leaking of the 601 hose in these limited types of applications. Based on data which Aeroquip has accumulated to date, it appears that this phenomenon is occurring after approximately two (2) years installation time (independent of actual service hours on the subject hose). To the extent your aircraft may be affected by this phenomenon, Aeroquip recommends that you inspect your aircraft to determine: (a) if your aircraft has 601-type hose fuel lines; and (b) the age and condition of said hoses. Aeroquip strongly recommends that any 601 hose, which is approaching, or has more than, two (2) years in an AVIATION GASOLINE application, be replaced in accordance with the recommended action outlined in this Service Bulletin.
Note: This Service Bulletin does not apply to applications using Jet A, JP4, JP8 grades of fuel commonly used for turbine/jet engines. It also does not apply to other fluids such as lubricating oils, REF. MIL-L-7808 or MIL-L-23699.

Editor's Note: It is interesting to note that this exact type of failure was reported as early as 1986 in the CP and several times since then. Do not use Aeroquip 601 series hoses for fuel lines. Use only Stratoflex Teflon lined, stainless, braided or equivalent MIL-H-8794 Hose, TSO'd to MIL spec. C53A.

WING FITTING VENTILATION - LONG-EZ

The outboard main wing attach fitting recesses in the wings should be ventilated to avoid an accumulation of condensation. Drill a #30 hole in the bottom cover. Remove the top cover and drill a hole in the lowest point of the recess such that it will break into the recess underneath the wing. This hole should allow a soda straw to slip through. Work a little micro into this hole and slip a soda straw through. Allow to cure. Now, carefully cut the soda straw flush with the bottom of the recess. Silicone the top cover back on. This will allow the two covered areas to "breathe" and eliminate condensation which could corrode the wing bolts.

SEE SKETCH TOP OF NEXT COLUMN

SKETCH OMITTED

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

SEE NEW EPOXY TO REPLACE HEXCEL'S SAFETY POXY.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

FOR SALE

NOSE GEAR RATCHET

Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it. Contact:

Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES

New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $30.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431

817-354-8064

THE "BEAD BUSTER" TM

If you have ever tried to remove a tire from a 500x5 wheel you will understand what a neat tool this is. (Mike purchased one of these tools and wonders how he ever got along without it!) Designed by a Long-EZ builder who became frustrated by this problem, the kit consists of a canvas pouch, a vulcanizing patch kit, cadmium plated fulcrum lever and base, and the heat treated aluminum "Bead Busting" shoe - $75.00.

Contact: Tom Caughlin
10958 National Blvd. #1
Los Angeles, CA 90064

AIRCRAFT COVERS

Custom cover for your Long-EZ. This neat design completely covers your prop, canopy and nose and only uses two straps. Made from space-age Evolution 3 material. Reasonable price.

Contact: Tony Brazier
PO Box 6478
Ocala, FL 32678
904-237-1811

FOR SALE

Two prop extensions for Continental engine - one is 3" long and is drilled, the other is 5" long and is not drilled.

I need a prop extension for a Lycoming. Will sell or trade.

I have two props for Continental A-75 - one is Ted's 58x63, the other is Hegy's 58x63. Both in good condition.

Contact: Richard Long
17220 Esperanza Dr.
Perris, CA 92570
909-780-3507

New 6" SAE #1 prop extension with crush plate - $150.00.

New A1 spinner with backplate - $50.00.

Contact: Jim Capistran
6016 Star Valley Street
Mesa, AZ 35205

New EZ axles for 500x5 Cleveland wheels - $600.00 pair.

Original Paul Prout EZ fuel gauge kit. Lighted, with low fuel warning. Complete, in the box. AVgas only - $100.00.

Contact: Jim Carraway
415-499-1163

Whelen #1 single flash strobe/position light system - new, in the box - $500.00.

Lycoming 0-235-C2C with carb, fuel pump, mags, spark plugs, HT harness, cylinders overhauled - 640TT - $2200.00 OBO.

Three year old custom 3 BR, 2 bath home near Scottsdale, AZ
Contact: Phil
602-837-8245

WANTED
PARTICIPANTS

THIRD NATIONAL GATHERING FOR CANARD TYPE AIRPLANES

June 11, 12, 13, 1993
Johnson County Industrial Airport (KIXD)
Olathe, Kansas

Social events, seminars, prizes

Guest speaker - Astronaut - Long-EZ builder,
Jim Voss

Contact: Terry Yake
8904 W. 116th Terrace
Overland, KS 66210-1963
913-451-8904

HELP!! -- We've lost John York! Last we heard, he was in Virginia and we don't know if his belhorn springs are available any longer. Please let us know if you have any information of interest to other builders. ED.

"Dear RAF;
Recently, when talking to the nice people at Feather Lite, Inc., I found that the Long-EZ cowling I wanted would cost a large percentage of the purchase price just for shipping. It seems that if the shippers know the material is aircraft parts, the price goes up dramatically! I have considered trying to build my own cowling, but I'm sure I'd fall short of the quality and light weight provided by Feather Lite.

The people I spoke to suggested that the shipping price could be greatly reduced if shared by two or more orders shipped at once, hence this letter. If there are any builders out there in the northeast who have not yet ordered their cowlings and would be interested in combining their orders to save money, perhaps they could contact me and we could arrange a combined shipment. The delivery of cowlings from a common location in this part of the country could be easily arranged. I can be contacted at:
David Kleinschmitt

5 Webb Road
Bethel, CT 06801
203-797-1081

SHOPPING

FLUSH, INTERNALLY MOUNTED ANTENNAS

A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk. Contact: Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

CANARD PUSHER DIGEST, 2ND EDITION

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now it its 2nd Edition. (For a complete description, see CP57). Includes all builder related information from CPs 24-72. The 2nd edition of the Digest has now grown to over 700 pages, and is professionally printed on double sided 8 1/2 x 11" paper from a laser printed master.

Quarterly updates to the Digest are also available. The updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

Note that the Digest is builders and flyers of the Long-EZ only. It does not support other RAF designs.

CP Digest for the Long-EZ (2nd Edition) $75.00
(Overseas orders add $20.00 for airmail
Annual Update Subscription (4 updates) $25.00
Overseas orders add $5.00 for airmail

CANARD PUSHER NEWSLETTERS "ON DISK"
Stet Elliott has also compiled the text of all the Canard Pusher newsletters in electronic format. The set includes all of the Canard Pusher Newsletters, from the very first one published in May of 1974, to the present. The set of CPs is provided in a text only format which should be 100% compatible with any computer word processor you presently use. It is available for either the IBM or Macintosh platforms. A hard disk is strongly recommended since the set contains over five megabytes of textual information!

This product is ideal for anyone interested in reading about the evolutionary development of RAF's canard designs through the years, or for

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those builders still plagued with the "I know I read it here somewhere!!" syndrome. With one of the inexpensive text search and retrieval programs, text string searches across the entire set of files are a snap.

CPs on disk costs $65.00. Specify disk size, (3 1/2" or 5 1/4"), platform (IBM or Mac), and disk capacity.

For either the CP Digest for the Long-EZ, or the CPs on disk, contact:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-4156

VARIEZE INDEX

Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file)for $24.00. Specify which you would want. This index will be updated annually.

Contact: Bill Greer
8827 Larchwood Dr.
Dallas, TX 75238
214-348-0215

PLEASE NOTE: Those of you who have the first edition, Bill has improved the indexing of several topics and added more cross-indexing You may find it helpful to get an up-grade.

DEFIANT FLYER

If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's letter on his Ford-powered Defiant in the December issue is a case in point. See CP67, page 2 for information on subscribing to the Defiant Flyer.

Seen at Oshkosh. Beautiful leather seat cushions (also available in various fabrics) for Long-EZ, VariEze and Defiant.
Contact: Diana Davidson

Alexander Aeroplane Co.
900 S. Pine Hill Road
PO Box 909
Griffin, GA 30224
404-228-3901

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00
Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	39.00

Go-A-Long-EZ 39.00

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

AIRCRAFT SPRUCE has opened a distribution center and order desk in England. They will handle the full line of homebuilt supplies and materials.

Contact: Aircraft Spruce
Unit 8, Cam Centre
Hitchin
Hertfordshire SG4 OTW
462-441-995

PERFORMANCE PROPS

While we continue to receive favorable reports from users of these propellers, we have received one very negative report. Warren North, Glendale, AZ bought one and tested it on his Long-EZ. He was not satisfied due to the blades cavitating/fluttering during a full power run-up on the ground. The prop also fluttered in flight at high power. He returned the prop for modification/repair together with a carefully prepared test report. When he got the prop back, it was no better and, in his opinion, was unsafe to fly. Warren is very experienced with a test pilot background.

We appreciate the report, Warren, and we continue to solicit reports on Performance Props from those who are flying them.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

The gorgeous VariViggen belonging to Carl Pieper of Cincinnati, OH.

CP74, Page 10

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Bruce points to some of the templates or patterns for the various props he has developed over the past 14 years.

Trimming the cracked ends off a piece of Hardrock Maple. This old crosscut saw was used to cut up the material for Bruce's first prop.

Placing a pile of freshly glued boards into the hydraulic press.

Rolling the glue onto each face of each board. Every square inch must be evenly coated.

Driving in one of his special steel locator pins. This prevents the boards moving relative to one another while in the hydraulic press.

CP74, Page 11

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Applying the pressure! Note the copious squeeze-out between boards!

"Master" prop in the foreground, new blank in the background. Note the large amount of material removed in the "roughing" cut.

New prop blank on the left, "master" prop on the right. Note large aluminum wheel with lightening holes which follows the "master" prop as it revolves.

Bruce holds two freshly carved blanks. These have just been removed from the automatic tracer lathe. Ends need to be trimmed, holes need to be drilled and then entire prop must be sanded and clear coated.

Boring center hole and 2-1/4" counter-bored hole.

CP74, Page 12

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Drilling six holes using steel drill fixture.

First stage of sanding prop after carving on tracer lathe.

How about this for a little bit of history? Burt, Mike Melvill and Michael Dilley. A Saturday demo at RAF in the "good old days".

CP74, Page 13

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Dave Timms in his Long-EZ N121DT, on December 5, 1992 prior to altitude flight after canopy has been sealed by NAA representative, Dick Freeborg.

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THE CANARD PUSHER No. 75 Apr 93

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Mojave, CA 93501
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Back issues	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 75.
VariViggen (2nd Edition), newsletters 18 to 75.
VariEze (1st Edition), newsletters 10 thru 75.
VariEze (2nd Edition), newsletters 16 thru 75.
Long-EZ, newsletters 24 through 75.
Solitaire, newsletters 37 through 75.
Defiant, newsletters 41 through 75.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every effort to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.
SOMETHING NEW HAS BEEN ADDED

The post office has decreed that a change be made to our address. The flight line number must appear above the city name or they will not deliver our mail beginning March 1, 1993.
Please read and heed.

OSHKOSH 1993 TALKS

July 30 - Friday - 10:00am - Tent #3 - Life, the Universe and Everything Else - Part III.

July 31 - Saturday - 8:30am - Design College - 10:00am - Tent #3 - Tent Talk

Show - Part III.
11.30am - NASA Tent - Talk on General Aviation.

August 1 - Sunday - 10:00am - Tent #3 - RAF Airplane Builder Support.

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June 11, 12, 13, 1993
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Jim Voss

Contact: Terry Yake
8904 W. 116th Terrace
Overland, KS 66210-1963
913-451-8904

CORRECTION

The telephone number given in Canard Pusher 74 for OSHA in Washington, DC was incorrect. The OSHA operator phone number is 202-219-8148. However, callers can save time (and money) by calling the publications office, direct, at 202-219-4667.

FROZEN CRANKCASE BREATHER

The following experience is reiterated in the hope that reading about it may prevent a similar problem, or at least allow someone unfortunate enough to run into this, to come through it undamaged.

Sally and I flew our Long-EZ to Telluride, Colorado this past February. We had planned five days of skiing in the San Juan mountains. We landed at Telluride airport which is at 9100 feet elevation. There was lots of snow and it was cold, especially at night. There was no hangar or tiedown available so we parked nose down, into the wind.

While we were there, it snowed four to six inches each night. The last night, we had 27 inches of snow. We had to dig the Long-EZ out of the snow before we could leave.

A careful preflight was conducted, followed by pulling the prop through enough times to show oil pressure on our mechanical gauge. The engine started easily and I warmed it up at low power. I did not taxi out for

take-off until I had 120 degrees F oil temperature. We took off and headed directly toward Page, Arizona at 14500 feet.

One hour out of Telluride, I suddenly noticed the oil pressure gauge fluctuating. The oil pressure slowly fell from 85 to 60psi. At this point, I hit the Loran "nearest airport" button and headed for the brand new Black Memorial airport near the northeast end of Lake Powell.

We removed the cowl and found that the engine had only 1-1/2 quarts of oil left in the sump. We had left Telluride an hour earlier with 7-1/2 quarts! There was evidence of oil near the push rod tube seals, the rocker cover oil drains, but no oil in the vicinity of the main bearing/prop seal. The prop had some oil on it, but not nearly as much as I would have expected considering we had lost 6 quarts of oil!

We topped off the oil, ran the engine for 10 minutes with no sign of an oil leak. We replaced the cowling and headed toward Mojave. One hour later, we had an exact repeat of the problem! This time, we landed at Boulder City, Nevada. It was much warmer there. We went through essentially the same steps again; filled up the oil, replaced the cowl and headed for home. One hour and 10 minutes later, we landed at Mojave and found that we had not used a perceptible amount of oil!!!

Here is my theory but, I hasten to add that I have no conclusive proof of anything at all. We have one of Wes Gardner's breather systems installed and we have run this system for more than 1500 hours without a problem. For those who may not be familiar with this system, it consists of a 5/8" I.D. hose that runs from the crankcase breather elbow to an anti-backfire valve welded into the exhaust system. There is a "T" fitting in this hose from which a 3/8" I.D. hose runs to an automotive PCV valve, and then to the intake manifold (in my case, a fitting is screwed into the Ellison throttle body in the venturi). At low power, the anti-backfire valve does not open and the crankcase breathes through the PCV valve and into the carburetor, then into the cylinders where the crankcase gases are burned in the cylinders and go out the exhaust. At higher power, the PCV valve closes and the anti-backfire valve opens. The breather gases flow directly into the exhaust system, are burned and expelled through the prop.

I later found that the anti-backfire valve had carboned up to about 80% blocked. I believe that the moisture, normally expelled from the breather, froze in the partially carboned and blocked anti-backfire valve. With the very low temperatures at Telluride, particularly at night, this moisture froze hard. Even though I warmed the engine until the oil temperature read 120 degrees F, this did not help because the breather system is located entirely on the "cold" side of the engine baffles. This means the cold air being pulled through the cowling during the engine warm-up kept the frozen breather frozen. The flight at 14500 feet (minus 20 degrees C) continued to keep the breather frozen.

With the normal crankcase vent (the anti-backfire valve) plugged, crankcase pressure built up and began to force oil out of the seals, as well as through the PCV valve, into the carburetor, up through the manifold and into the cylinders where it was burned and expelled out of the exhaust. I believe this continued at a rate of 6 quarts per hour,

or 0.1 quarts per minute. In other words, the engine burned most of the oil

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while some of it leaked out of the seals. The small amount of oil found on the prop, on the engine and in the cowling supports this theory although, to be honest, not everyone agrees with this hypothesis.

The temperature at Black Memorial airport was cold enough so that the frozen blockage did not melt. The temperature at Boulder City was in the low 80's - this finally melted the frozen breather ice and so we did not use any oil from Boulder City to Mojave.

I replaced every part of the breather system, new hoses, new PCV valve, new anti-backfire valve. I did not find anything wrong with the original parts, for what that is worth. I ran a 3/8" drill through the carboned up anti-backfire valve mounting and was surprised at the amount of carbon that came out. In the 40 hours flown since this incident, oil consumption has been normal (about 1 quart per 14 hours).

I intend to keep on using Wes Gardner's breather system. It has given excellent service for hundreds of hours. I will, however, do two things differently from now on. I will check the carbon build-up and clean it out every 100 hours and, I will pre-heat the engine compartment before starting it if it has been left out, overnight, in sub-zero weather. I would recommend that anyone using this breather system do the same thing.

I would value any and all opinions about this incident. Has anyone else out there has anything like this happen to them?

Mike Melvill

LEAKY MA-3 CARBURETOR?

Once upon a time, I believed that OEM (original equipment manufacturer) made parts were the only reliable way to go. After all, if they made it originally, they should be the best equipped to make the replacement parts and have their good name, and day in court, to gamble if the parts are defective. This fairy tale usually ends with "and they all lived happily ever after". Reality is a bit different, I found recently.

My 0-235-C powered Long-EZ has over 1000 hours on it with the same badly worn MA-3 carburetor which was on it at first flight. I decided it would be a good time to comply with all the service bulletins and replace the throttle shaft, 2 piece venturi, and finally, change from the composite float.

Two hundred and seventy-five dollars later, I replaced the freshly overhauled carburetor and turned on the fuel pump to leak check the installation. I was amazed to see fuel pour out the overflow hole at the bottom of the venturi. I returned the unit to the overhaul

facility where the mechanic disassembled it and declared it was OK and to try it again. I installed the carburetor and the mechanic decided the needle and seat must be leaking. Sixty dollars later, I put the carburetor back on again. (I'm getting better at carburetor R&R.) Once again, the unit leaked like a sieve. I returned the unit and told the mechanic to lower the float level below what the OEM specified.

The lower float level helped. It passed the pressure test in the hangar. I took the airplane outside and started it up with great difficulty. After a 5 minute run, I shut the engine down and watched fuel run out of the carburetor again. By then, I was assured that Mr. Marvel and Mr. Schebler didn't know who their fathers were.

The mechanic said he had no idea what was wrong and left me to thoughts of getting my glider rating dusted off.

A chance encounter with Bob Wilson of the Ayling & Reichert Company, which manufactured the floats for Precision Airmotive, revealed the reason for my problems. It seems that Marvel-Schebler-Facet-Precision Airmotive are not manufacturers of anything. They just assemble parts that are produced by other manufacturers. I discovered the float I bought for $125.00 from Precision had been sold to them by Ayling & Reichert for $6.00. Who says there is no money in aviation?

I was told that Precision told Ayling & Reichert to manufacture a batch of floats and supplied original drawings. The newly manufactured floats did not fit in the carburetors and, consequently, stuck. Careful dimensional checking by Ayling & Reichert assured that their

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floats did agree with the Precision Airmotive supplied drawings. The only variable left was the carburetor bowl casting. Ayling & Reichert measured an assortment of MA-3 castings and discovered they varied widely. It was discovered that the original castings were made using badly worn tooling and that each carb casting was slightly different from the previous one. The end effect was that each newer carburetor had a slightly smaller fuel volume and less clearance between the float and the casing walls. I was told Precision Airmotive was informed of the wide dimensional variation problem but insisted on producing the floats to the original plan. Because of this, some MA-3 carburetor floats stick, thereby, causing leaks and very rich mixture settings.

The mixture can be so rich that the engine will not develop full power and runs very roughly. I've heard of cases where pilots have made precautionary landings because the engine was running so roughly that stoppage was predicted. I wonder how many "Engine lost power" accidents can be attributed to sticking floats in these FAA approved carburetors.

Now that the cause is apparently known - what is the fix? Bill Smith of Consolidated Fuel Systems had Ayling & Reichert make a batch of floats that supposedly do fit and work in the MA-3 carburetors with the undersize float chambers. Call him at 205-286-8551 or information.

To fix your existing Precision Airmotive float system, you might try Bob Wilson's suggestion. First, you need to determine where the float is sticking and then increase the clearance so it does not touch in the future.

To do this, you must remove the carburetor and drain it completely. Paint the float with Prussian blue toolmakers ink then reassemble and shake like crazy in all direction. Remove the carburetor top and look to see where the ink has been applied to the casting wall. Those spots are where the float has been touching. Clearance in those areas needs to be increased. I elected to Dremel the inside of the casting and then polish with succeedingly finer abrasive papers. Repeat the blue ink procedure until no more float contact is observed.

I suppose one might also alter the float but that is pretty risky business as leaks are easy to get and hard to fix.

I tried the trick of grinding out the inside of my float bowl and reinstalled the carb, knowing I'd finally solved the problem. Guess what? It still leaked.

I then screwed a fitting into the float bowl drain and rigged a clear tube sight gage to it so I could monitor fuel level while the carb was under pressure. I found the fuel level was moving swiftly up to the desired level and then SLOWLY moving higher and higher until it overflowed out the float chamber vent.

That indicated the brand new Precision Airmotive needle and seat assembly must be leaking. I replace it with an STC'd Consolidated Fuel Systems part and, PRESTO, the fuel level stayed right where it should have stayed. Ahh, so much for OEM high priced parts. Or so I thought.

I took the airplane out to run it up and it worked fine. I cowled it up and tried to start it. It acted too rich - and then I saw the puddle of fuel again!

I then sent it away to one of those high dollar repair places and for $158.60, I found the $3.00 clip that holds the needle to the float assembly was at fault. It no longer provided proper alignment between the needle and seat. I reinstalled the carb and it seemed to work properly. I now have two flights on it and nothing is running out the bottom of the cowl. Could it be the problem is solved?

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SUCKER HOLE

For several years, when two or more clouds are in the sky, we have heard the Flight Service Station weather briefer say "VFR not recommended". And since this started, I have shouted that they are crying "Wolf". Any experienced pilot knows the briefer is practicing CYA and most briefers are not pilots. So for years, we hear and ignore. Eventually, someone is going to get into trouble,

maybe killed and "pilot error" will be the cause as "VFR not recommended" will be on the tape.

Thursday, July 30, 1992

My flight is from Tallahassee to Oshkosh with a lunch stop at Huntingburg, Indiana. The Tallahassee Flight Service weather briefer warns of two frontal areas, one over Chattanooga, TN and one extending from Champaign, IL to Ohio across my route. "VFR not recommended" is read like a Miranda notice. Haze and two miles visibility at TLH means a special VFR departure; no problem. I climb quickly to 6500 feet and head north. Cloud cover below soon becomes solid. At Chattanooga, I am VFR on top. Flight watch informs of the frontal activity from Champaign, IL to Ohio with many thunder storms across my route. "VFR not recommended" results in a "Roger" acknowledgement. The Flight Watch briefer adds, "You are not going ahead, are you?". Another "Roger your information, thanks" ends the discussion. Soon the solid cover breaks and I land at Huntingburg after four hours, thirty minutes flying from Tallahassee.

A microwaved sandwich, some fuel, and I climb to 8500 feet, anticipating the need soon to reach 10500 feet to pass over the Chicago TCA. From west to east, as far as I can see ahead are towering cumulonimbus formations, perhaps ten miles apart. As I approach Terre Haute, IN, I see no breaks in the line. Where a CB ends, solid clouds with light to moderate rain fill the gaps. Turning westward, I head sixty or seventy miles toward Champaign, which is reported to be the end of the easterly moving frontal activity. However, I see blue sky through a gap in the line of CBs at my altitude and I turn into my personal "sucker hole".

Light turbulence and light rain cause me to glance down to pull on carburetor heat, reduce throttle setting, stabilize the aircraft, and slow the Long-EZ to the maneuvering speed of less that 120 knots. The I glance at the altimeter. Instead of 8500 feet, it indicates 13400 feet. Up a mile in seconds! Suddenly, I see lightning off my left wing. The VSI is pegged at 2000 feet per minute, worthless! Now I move the throttle to idle and the nose down ten degrees for an airspeed of 110 knots. The light rain becomes heavy rain, then hail. The turbulence is minor; the altimeter slows at 15600 feet. An ascent of a mile and a half in seconds means the updraft is over 100 miles per hour! There is no sensation of the vertical speed. The plane seems to be flying at 110 miles per hour straight and level. Yet, what goes up . . .!

As the plane passes from the 100-plus mile per hour updraft into the compensating down draft, the sharp shear force is tremendous. The plane shudders, as if it has hit a solid wall. Negative G-forces cause everything in my shirt pocket to fly out; the ELT pops out of the clamps holding it in place. In spite of a tight seat belt, my head hits the canopy. During a flight from Bogota to Panama on AVIANCE Air Line, I experienced CAT. Passengers and hand luggage flew through the cabin but this hammering shock of the sharp wind shear is far, far worse. The shuddering of the aircraft is the heaviest shock I have ever felt in a plane, so bad I do not expect to see the wings still attached. My first thought is "If this is it, so be it". This is

interesting, as I never use this expression. My second thought is "Thanks, Burt Rutan for designing a strong aircraft, and thanks Tom Caywood for building to specifications". The rest is anti-climatic as the down draft takes back the free ride up and I enter clear air at 9000 feet.

Using Rich Domke's hand held VOR, I find Mattoon, IL and stop for the night.

After climbing out of the Long-EZ, I was shocked when I saw the hail damage to the leading edges of the canard and wings and the amount of paint removed from the landing struts and winglets. Immediately, I walked to the rear to inspect the prop. By the time I entered the hail, I had pulled the throttle back to idle. With little or no thrust or drag, there was no wood damage. The urethane leading edge of the wood prop eroded slightly along the outer ten inches. Close visual inspection of the EZ revealed no signs of cracks or stressed structural areas from the outside.

Early Friday, July 31, I flew out of Mattoon to Oshkosh. The damaged canard destroyed almost all the laminar flow, requiring full aft trim and some positive stick pressure to maintain straight and level flight. At Oshkosh, I talked to Burt Rutan about the hail damage.

Burt, Mike, Bruce Tifft and I were all parked together. Mike held an informal discussion and information exchange session for Rutan builders

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and flyers at the Defiant every day at 1:30PM. After the Saturday meeting, he examined the aircraft and reassured me concerning structural damage. Then, he advised me to flox the holes where the hail cut through to the foam and apply micro to reform the leading edges of the canard and wings.

Bruce Tifft showed everyone how great his prop resisted the forces that destroyed the leading edges of the wings and canard. He also advised me to sand lightly with a fine grit paper to restore the polish to the urethane leading edge.

CONCLUSIONS:

The hole revealing the blue sky had ample room for the plane to fly through. The surrounding rain and clouds were very light in color, not the dark mass normally associated with cumulonimbus and severe thunderstorms. No lightning was visible from outside the clouds. The thunderstorm was imbedded. Yes, I was suckered.

Once the hole closed, I should have made an immediate 180 degree turn to exit. Then I could have continued VFR westward to pass the end of the line or find an airport and land until the weather improved.

Never let the urgency or desire to arrive at the destination interfere with flying judgment and decisions. Respect the the power of nature. Do not let the attraction of a light, thin area of clouds and light rain prevent thinking rationally. There may be a "sucker hole".

Due to the tremendous sharp wind shear between the strong updraft and down draft, I do not believe an aluminum light aircraft could have withstood the abrupt shock of the shear force encountered. The impact was incredibly severe.

AL Hodges
9850 SW 15 Street
Miami, FL 33174
305-551-0384

HURRICANE ANDREW - (Before dawn, Monday, August 24, 1992)

On Sunday, August 23, 1992 several of us gathered at Tamiami Airport (Miami, FL) to store our planes in a hangar to avoid damage from the impending storm.

"Why did Florida Power and Light fly out instead of storing their jet in their hangar?", I asked Bob Hitchcock, manager for the FBO, Jet Center.

"Would you leave a $10 million jet in a hangar built by the lowest bidder?". I laughed. By Tuesday, it was not funny.

Sunday, we carefully eased the planes into the Jet Center hangar. All the way back against the wall was a beautiful SNJ. My Long-EZ and a Swift filled the back row, nestled but not touching. Each plane was chocked. A Cessna 180, a 172 and a Twin Comanche filled the next row. Then another 172 was eased into safety and steel doors closed to protect our planes. By Tuesday morning, Tamiami was a total disaster. Every hangar except three were destroyed. Approximately 500 airplanes were totaled, later to be piled up in a scrap heap. Driving around the airport caused a big knot in the pit of my stomach. Perhaps 20 to 30 airplanes were flyable, an equal number repairable. Approximately 0.5% of America's total air fleet was wiped out, including the hangars and aircraft in Kermit Weeks' museum. His B-17 came to rest about a mile from the museum hangar. A C-46 ended upside down about a third of a mile from its parking place.

The Jet Center hangar, facing the hurricane, had the steel doors blown away and panels in the rear forced open, letting the full power of the storm flow through the hangar. All planes were pushed back to less than half the hangar floor space. The SNJ was pushed up the back wall, stopping when the tail went through the roof and the propeller was resting on the floor. Blue paint covers part of the Long-EZ upper wing surface, left by the SNJ as it scraped across the top of the EZ wing. The 180 was totally destroyed and the pressure of moving and compacting of scrap aluminum forced the 180's crushed wing under the EZ. This lifted one EZ wheel off the floor and delaminated a few square feet of the lower wing surface, but there seems to be no spar damage. Both rudders and winglets took a beating from flying debris and the bashing from the remains of crushed aircraft. The right wheel was doubled under at about a 30

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degree angle. The remains of the Swift scraped the paint off one strut and one layer of glass on the strut is delaminated. No canard damage, no prop damage, no cowling or engine damage, and only cosmetic damage to the fuselage except for a broken canopy.

After removing the aluminum scrap blocking access to the EZ, I was able to walk the plane from under and behind the SNJ wing. When the pieces of the 180 were dragged from under the EZ, the wheel snapped back to its normal angle. Unbelievable! EAA Chapter 620 members, Mike Chenoweth and John Taylor, helped remove the canard and wings. Then, we loaded the bruised bird on a trailer and hauled it to my house for repair. Perhaps by Christmas, I will be flying again. Bruce Tifft can show everyone how his propeller stood up to Andrew and hail.

As a supplement to the "Sucker Hole" storm incident going to Oshkosh, I quickly checked for any crushing or cracking around the wing bolts after removing the wings. What a relief to find no signs of any damage or stress cracks. Again, thanks, Burt Rutan, for designing a strong aircraft. During 30 days, this Long-EZ suffered extreme stress and strain.

Now, let's continue to plan for the flight around the world next May through July.

Al Hodges

DAVENPORT SHIMMY DAMPER UPDATE
I'd like to report on a letter which was received from Mark Buxbaum of Richland WA. It seems, after making a series of "not so good landings" last summer, he experienced catastrophic shimmy on landing at Dubois, WY. This occurred with the Super Shimmy Damper installed!! After replacing the nose gear assembly with another complete assembly, including a Super Shimmy Damper, Mark continued on his way to Oshkosh with no further problems.

On returning home and checking over the failed nose gear assembly, Mark discovered he had bent the wheel disc on one of those "not so good landings". Run-out was found to be .020" which be believes drove the nose wheel to oscillate beyond the capacity of the shimmy damper.

If that is correct, then we should all check our nose wheels for run-out regardless of the type of shimmy damper installed.

Mark did not indicated which type of wheel was installed, but my guess is his unit was of the single center disc type with the overhung wheel bearings. This wheel is very prone to bending and failing under a side load and could possibly provide a little excitement in your life similar to Marks' experience.

A far better choice would be a Gerdes nosewheel (part # NWA 1230 from Wicks). This wheel is made just like the main wheels and has proven to be very reliable in Mike's Long-EZ for more than 1000 hours.

I occasionally get requests for the Super Shimmy Damper from people who are near first flight. I feel I need to clarify the supply situation. I do not have a machine shop and, therefore, subcontract all parts to a high quality shop. I keep no inventory of parts or complete

assemblies. I hold all orders until a total of 25 accumulate. That quantity is required to keep the delivered sale price to $71.48. All checks are kept until two weeks prior to shipping. Save yourself a disappointment by ordering the unit when you can afford a waiting period that won't disrupt your schedule.

Bob Davenport

ANOTHER REPORT OF A CRACKED ENGINE MOUNT

W. A. Theeringer, Long-EZ builder/flyer, discovered several cracks in, or adjacent to, the welds on his engine mount. After 650 hours of flight, per the CP73 recommendation for inspection, hair line cracks were discovered. The engine mount was returned to Ken Brock where it was repaired. So far, with 10 hours on the repaired engine mount, he feels less low frequency vibration and the mount is holding up fine.

Do not neglect to inspect for cracks in your engine mount. This is very important. If you find any cracks, do not fly until they have been repaired by a qualified welder. Also, please send a report in to RAF.

CRACKING EXHAUST SYSTEMS

Tom Caughlin reports that there have been several examples of his own exhaust system, as well as Hal Hunt's exhaust systems, that have cracked. If you own one of these exhaust systems, please check it for cracks before your next flight.

Contact Tom Caughlin for further assistance:
10958 National Blvd. #1
Los Angeles, CA 90064

Editor's comment: Seven years ago, I designed and built a four pipe exhaust system for my own EZ. It was essentially the same as what Tom Caughlin and Hal Hunt subsequently marketed. I had numerous failures, cracked pipes, cracked supports, all kinds of problems, some of which caused severe damage to my prop! My own solution was to weld a Brock ball joint into each of the four pipes which allowed some movement in the exhaust system. The pipes were connected in pairs with a slip-type connection. (Not welded together). This system has been in service for over 1000 hours with only a couple of minor cracks and no loss of pieces - and no damage to the prop.

Any four pipe exhaust system would have slip joints or Brock ball joints in each pipe. If not, they will crack. Check yours before next flight and get it fixed.

SHOPPING

FLUSH, INTERNALLY MOUNTED ANTENNAS

A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum

performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk. Contact:

Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

CANARD PUSHER DIGEST, 2ND EDITION

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now it its 2nd Edition. (For a complete description, see CP57). Includes all builder related information from CPs 24-72. The 2nd edition of the Digest has now grown to over 700 pages, and is professionally printed on double sided 8 1/2 x 11" paper from a laser printed master.

Quarterly updates to the Digest are also available. The updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

CP Digest for the Long-EZ (2nd Edition) $75.00
(Overseas orders add $20.00 for airmail)
Annual Update Subscription (4 updates) $25.00
(Overseas orders add $5.00 for airmail)

CANARD PUSHER NEWSLETTERS "ON DISK"

Stet Elliott has also compiled the text of all the Canard Pusher newsletters in electronic format. The set includes all of the Canard Pusher Newsletters, from the very first one published in May of 1974, to the present. The set of CPs is provided in a text only format which should be 100% compatible with any computer word processor you presently use. It is available for

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either the IBM or Macintosh platforms. A hard disk is strongly recommended since the set contains over five megabytes of textual information!

This product is ideal for anyone interested in reading about the evolutionary development of RAF's canard designs through the years, or for those builders still plagued with the "I know I read it here somewhere!!" syndrome. With one of the inexpensive text search and retrieval programs, text string searches across the entire set of files are a snap.

CPs on disk costs $65.00. Specify disk size, (3 1/2" or 5 1/4"), platform (IBM or Mac), and disk capacity.

For either the CP Digest for the Long-EZ, or the CPs on disk, contact:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-4156

VARIEZE INDEX
Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file) for $24.00. Specify which you would want. This index will be updated annually.

Contact: Bill Greer
8827 Larchwood Dr.
Dallas, TX 75238
214-348-0215

PLEASE NOTE: Those of you who have the first edition, Bill has improved the indexing of several topics and added more cross-indexing You may find it helpful to get an up-grade.

DEFIANT FLYER
If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's letter on his Ford-powered Defiant in the December issue is a case in point. See CP67, page 2 for information on subscribing to the Defiant Flyer.

Seen at Oshkosh. Beautiful leather seat cushions (also available in various fabrics) for Long-EZ, VariEze and Defiant.
Contact: Diana Davidson
Alexander Aeroplane Co.
900 S. Pine Hill Road
PO Box 909
Griffin, GA 30224
404-228-3901

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00

Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel.
$40.00
Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	39.00
Go-A-Long-EZ	39.00

NEW FOUR PIPE EXHAUST SYSTEM
Nat Puffer has designed and tested a new exhaust system for his Cozy. He tells us it will fit any pusher, including a VariEze or Long-EZ. There are slip joints at the flanges to prevent cracking and stainless springs are included to retain the exhaust headers into the short slip joints. These exhaust systems can be ordered directly from the manufacturer:
Custom Aircraft Supply
1318 Gertrude Street
San Diego, CA 92110
619-276-6954

$500.00 includes shipping, handling and packaging.

Nat has had good luck with a heat muff wrapped around both #2 and #4 exhaust headers. There may, or may not, be enough room in an EZ cowl to do this.

FOR SALE

NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it. Contact:

Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $30.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

THE "BEAD BUSTER"TM
If you have ever tried to remove a tire from a 500x5 wheel you will understand what a neat tool this is. (Mike purchased one of these tools and wonders how he ever got along without it!) Designed by a Long-EZ builder who became frustrated by this problem, the kit consists of a canvas pouch, a vulcanizing patch kit, cadmium plated fulcrum lever and base, and the heat treated aluminum "Bead Busting" shoe - $75.00.
Contact: Tom Caughlin
10958 National Blvd. #1
Los Angeles, CA 90064

AIRCRAFT COVERS
Custom cover for you Long-EZ. This neat design completely covers your prop, canopy and nose and only uses two straps. Made from space-age Evolution 3 material. Reasonable price.
Contact: Tony Brazier
PO Box 6478
Ocala, FL 32678
904-237-1811

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

NO PLANS CHANGES THIS CP..

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

AIRCRAFT SPRUCE has opened a distribution center and order desk in England. They will handle the full line of homebuilt supplies and materials.

Contact: Aircraft Spruce
Unit 8, Cam Centre
Hitchin
Hertfordshire SG4 OTW
462-441-995

SOME OBSERVATIONS ON THE PTM&W EPOXY SYSTEM

RAF has already received a few complaints about the newly recommended replacement for Hexcel's Safety-Poxy. Now hear this, People: When RAF

learned that Safety-Poxy contained an unacceptable level of MDA, a known carcinogen, we immediately began testing various epoxy systems. The goals were as follows: 1) Must contain no known carcinogen. 2) Must have as good, or better, performance characteristics. 3) Should contain no styrene (causes allergies).

Close to 100 different epoxies have been looked at and, at this pint in time, the only system meeting all goals is PTM&W. In some ways, PTM&W is a little less desirable. It is more viscous and it takes more effort to wet out the glass. We have found that it works well when using a squeegee, but not quite as well when stippling with a brush. However, the PTM&W epoxy is as strong and slightly exceeds the "TG" or heat distortion point of Safety-Poxy.

It is not perfect. Unfortunately, we live in an imperfect world but, the facts are that you do have a choice. Safety-Poxy will be available for the foreseeable future and no one is holding a gun to your head. If you prefer to use Safety-Poxy, that is your prerogative. RAF does not recommend using Safety-Poxy. If, for your own reasons, you must use Safety-Poxy, protect yourself from skin contact (wear protective clothing, gloves, etc.). Also, wear a respirator.

In spite of the workability of PTM&W being a little different, we are using it and getting used to it. We strongly recommend that you use it, too.

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

AHHH, THE GOOD OLD DAYS!!!
(EARLY PHOTO OF BURT , "DARTH VADER" AND VARI-EZE)

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THE CANARD PUSHER No 76 July 93

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Back issues	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 76.
VariViggen (2nd Edition), newsletters 18 to 76.
VariEze (1st Edition), newsletters 10 thru 76.
VariEze (2nd Edition), newsletters 16 thru 76.
Long-EZ, newsletters 24 through 76.
Solitaire, newsletters 37 through 76.
Defiant, newsletters 41 through 76.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every effort to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.
BURT'S BIG "5-OH" BIRTHDAY BASH

Sorry if you missed it!! The party on July 10th was organized too late to get it into the last CP. We'll have pictures and information for you next time.

OSHKOSH 1993 TALKS

July 30 - Friday
10:00am - Tent #3 - Life, the Universe and Everything Else - Part III.

July 31- Saturday
8:30am - Design College -
10:00am - Tent #3 - Tent Talk Show - Part III.

11:30am - NASA Tent - Talk on General Aviation.

August 1 - Sunday
10:00am - Tent #3 - RAF Airplane Builder Support.
2:30pm - Young Eagles Pavilion - Recognition of EZ Duck GliderBuilders.

MORE OSHKOSH '93

GET YOUR OSHKOSH '93 BUTTONS AT THE RAF BOOTH THIS YEAR - $1.00. Long-EZ builder/flyer, Buzz Talbot of Bolingbrook, IL contacted RAF with this great idea to help us defray costs. He generously offered the use of a button maker which we appreciate very much. Sure is nice to know RAF still has such good friends after all these years.

Bring your pass to the booth and have it made into a lasting keepsake.

VIDEOS OF BURT'S TALKS AT OSHKOSH '93
For those of you who have asked each year for video copies of Burt's talks at Oshkosh, stop by the RAF booth and pick up an order form. Details are being finalized as this CP is being typed.

TRUCK-EZ TESTS - THE LATEST ON DEEP STALL
For several years, we have been trying to obtain information and data on the characteristics of various canard-types at deep stall conditions. Data for the VariEze has been available since the late 70's when NASA conducted rotary-balance wind tunnel tests and concluded that the VariEze has no stable spin modes, i.e., that if forced to any angle of attack and spin rate, it will recover by itself. Also, the small model tests showed normal flat-plate drag at high angles of attack. These data and extensive stall-departure flight tests with N4EZ formed the basis for our confidence in the deep-stall safety of these general aircraft types.

Then, about 5 years ago, several accidents occurred with the Velocity aircraft. We think the problem could have been determined if extensive aft-CG departure testing had been done during development, like we did with the Long-EZ and Defiant. Two very noteworthy results from these Velocity accidents were 1). The descent was a stable, non-rotating condition about 50 to 80 degrees AOA, not recoverable with forward stick or by rocking the wings. 2). The descent was slow enough to allow impact in water without pilot injury.

Rumors were abound about this slow, 1000 ft./min. "parachute-like" descent probably induced by a violent, trapped vortex above the wing. Researching this, we found the rumors were just speculation, that there was no hard data on the descent rate. Even the test pilot who stayed with a Velocity to the ocean instead of using his parachute admitted he had not timed the altimeter nor remembered the rate-of-climb

indicator's data. He merely climbed partially out, but feeling the "light breeze" of the descent, elected to ride it down. We have been extremely skeptical that an airplane can descend at this low rate, even with the best possible vortex. To put things in perspective, consider what would be required. The EZs and the Velocity have a "loading" of about 10 lb. per square foot of total planform area (including wings, canard, fuselage strakes and cowl). If all this area acts like a "flat plate" in the descent, the airplane would sink at 50 knots or 5000 ft./min. (flat plate Cd=1.24). The very highest Cd we have seen in aerodynamic research papers on trapped vortex is about 10. Using a Cd of 10 for the entire airplane (very unlikely, of course), the sink rate would be 17 knots or 1800 ft./min. If the airplane could descend flat at 1000 ft./min. (only 9.9 knots), it would have a Cd over 30!!

Our interest in this phenomena certainly was increased after the deep stall accident of a Long-EZ at Kanab (CP 68). Now we had some data, but very poor data. Only a tiny image of the airplane during the last 2.8 seconds on a video tape. This airplane hit the dirt without killing the pilot so we believed it could not have been descending at 5000 ft./min. An attempt to analyze the video resulted in a very rough approximation of 2900 ft./min. which results in a Cd of 3.7. Our surprise, of course, was that forward stick did not recover from the deep stall. The surprise subsided when we later learned that the airplane was being flown with the CG well aft of the FS 103 aft limit.

While the 2900 ft./min. sink estimate seemed to make sense, it was not considered accurate due to the problem of measuring a fuzzy blip on the video. We then made a decision to try to gather full scale data on the Long-EZ. The previous full scale tests done in Florida on the Velocity did not measure drag and lift, only the more important data of recoverability with various airplane modifications.

Then, another Velocity deep stall accident occurred. This one descended inverted, hit land, not water, and killed the pilot. In this accident data was available - good, accurate radar and transponder data. Obtaining this data from the FAA is a story in itself.. Finally, after threatening a media expose about government cover-up, we received the data. This Velocity entered a deep stall at about 7000 ft. and descended at a nearly constant 4400 ft./min. (44 knots) for the entire 90 seconds to impact. Of course, this inverted descent data may not apply to an upright Velocity but, at least, for the first time it represented good data during a deep stall accident.

We proceeded to develop the rig to allow us to measure the Long-EZ. This turned out to be a much more difficult and expensive job than originally thought. It was made possible by the loan from Donald Douglas of Sherman Oaks, CA of his Long-EZ that is accurately built to the plans, without modifications. A 3-axis electronic balance was built to measure lift, drag and pitching moment and an accurate speed indicator was installed in front of an Isuzu truck. These "Truck-EZ" tests can only be done in dead calm winds, so after many delays, we were able to obtain data at 40, 50, 60, 71 & 80 degrees angle of attack.

The data are presented in this newsletter. Note that these are full-scale tests at near the same Reynolds number as flight, so they are much more accurate than the small scale model tests done by NASA in the 70's.

First, let's discuss the lift and drag data. The data show substantial scatter due to the truck riding over bumps in the runway. A line faired through the average of scatter is considered reliable. If we combine the lift and drag resolved to a total reaction that would support the airplane during a stable deep stall descent, we can calculate the sink rate. This data, sink rate vs. angle of attack, is shown. Note that this prediction is very close to the radar data of the Velocity (4400 fpm).

Now, how slow does a Velocity descend upright in the deep stall attitude? We don't know, but we now tend to suspect that it is relatively high, 3500 to 4500 ft./min. We reason that the low damage and pilot survival is related to the fact that the water impact is nose down and the bottom fuselage is curved, this allows a few feet of deceleration at impact which can explain the lack of pilot injury.

How slow does a Long-EZ descend in a deep stall attitude? First of all, our pitching moment data show that it cannot descend at the extremely flat attitude of 70 to 90 degrees angle of attack. The pitch data indicated that if the CG is aft of limit, say F.S. 106, the aircraft may hang up at about 40 to 50 degrees angle of attack. It would then descent at about 5000 feet per minute. Why did the Kanab pilot survive? Possibly the nose-low attitude allowed a couple of feet of "crush and rotate" deceleration that provided adequate protection.

Our concern now is that there are many Long-EZs with extensive modifications that can affect deep stall recovery (long noses, bigger strakes, baggage pods, etc.). While we do not approve these modifications and can't be expected to analyze or test each one, we do feel obliged to encourage everyone to conduct adequate testing to determine the safety of their own modified airplane. Conduct stall tests at the CGs you fly, with adequate altitude for a parachute jump (egress above 8000 ft. AGL). Do not ride it down, even over water.

Another concern is that many of you do not accurately know your CG position. Calculating weight and balance is a pilot's responsibility (FAR 21) for each flight. Be sure you fly within limits (your own test-verified limits for modified airplanes) and check CG when any changes are made.

CP ADVISORIES AND RECOMMENDATIONS
These are for your protection. All that RAF can do is tell you. It is up to you to comply for your safety, as well as any passengers you may take up. Keep your aircraft TOTALLY up to date on all CP advisories and recommendation.

Not everyone who is flying a RAF design receives the CP. If you know of anyone who may not read the CP, make it your business to get involved, lend him (or her) your CPs (or copies of the CPs - we encourage copying the CP). The whole purpose of the CP is to help you fly as safely as possible.

If anyone knows of a condition that may have developed over the years or of any unsafe situation, PLEASE send us a letter detailing the problem. Help us to get the word out.

PROP BOLT TORQUE

Not again, you say? We are all well aware that there have been many admonishments in the CP over the years regarding the critical importance of correctly torquing your prop bolts, and of doing this often, and at regular intervals.

Recently a friend borrowed a wood prop from an EZ builder in a state where the moisture is much higher than it is here in Mojave. This prop was installed, the bolts were torqued to the recommended value, the bolt heads were safety wired. After only about 30 hours of flight here in the dry desert air of Mojave, this friend discovered that the safety wire had broken and that all six prop bolts were loose enough to be able to turn the washers under the bolt heads with his fingers! What happened? This prop lived for a couple of years in a damp climate. The wood absorbed some of this moisture and swelled a little. After a few weeks in the dry climate of Mojave, the wood lost most of this excess moisture and shrank. The bolts were no longer squeezing the prop between the crush plate and the prop extension flange. The prop began to move just a little, causing the face of the prop to char slightly. The bolts began to unscrew themselves and it literally would not have flown more than a few more minutes before this prop would have come off the airplane.

Wood props, used correctly and properly maintained, are very safe and have an excellent safety record over many years. However, the torque on the prop bolts must be checked regularly. If you have a new prop from a wetter climate than where you live, check the torque every 10 hours for the first 100 hours. Once the prop settles down, you can extend these checks to every 25 hours. Do not omit this simple safety check. It could be extremely costly if you do.

A CROSS COUNTRY TRIP WITH GPS

I recently installed a King KLN-90 GPS in our Long-EZ, N26MS. The installation was simple and, the best news of all, the antenna installation is a piece of cake! (Compared to a Loran antenna.)

The King GPS is, of course, pretty much the top of the line, state-of-the-art with all the bells and whistles, and it really makes navigating, VFR or IFR, easy. The amount of information available at your finger tips is simply mind boggling.

Our first cross country with the GPS was a couple of weeks ago when we flew back to Anderson, Indiana to attend a wedding of one of Sally's nephews. We departed Mojave early in the morning and climbed directly to 17,500 feet. Breathing oxygen through our cannula AEROX system, we flew to Pittsfield, Ill, non-stop, 1333 nautical miles (1533 statute miles) in 7 hours and 6 minutes at an average speed of 188 knots (215 mph). We burned exactly 48 gallons of gas for an average of 27.7 nmpg (32mpg). Try that in your foreign car - 215mph at 32mpg! Wow, the old Long-EZ is still awful hard to beat. N26MS has over 2030 hours total

time and she is nearly 13 years old. Total flight time to Anderson was 8-1/2 hours. Total flight time back to Mojave from Anderson was 10 hours. We flew back at low altitude against a headwind and used 80 gallons coming west compared to 60 gallons going east. What a difference a tailwind can make!

The GPS performed flawlessly, the accuracy was amazing and rain, thunderstorms, lightening and low altitude scud-running (all the while running a CD player) had no effect whatever on its operation. (Our Loran used to drop off the line due to static build-up in bad weather, just when you needed it most!). The King even has a simple moving map mode that is really the way to go when running under the scud in low ceiling and low visibility conditions.

In spite of the military deliberately "dithering" the satellite signals, the GPS works much better than Loran. (We had a King KLN 88 Loran.) It is much more stable, ground speed readout is close to DME for stability, whereas Loran ground speed varies constantly. I believe the military will eventually be forced to quit the "dither" which will give incredible accuracy. I also believe that GPS will be ultimately the primary enroute navigation system. Already GPS is approved for some IFR operations, so if you are in the market for a navigation system, consider GPS over Loran for potentially greater accuracy, much better weather capability, easier installation and better reception in a fiberglass airplane.

If you do decide on a GPS (or Loran), consider this: Pick one with knobs, not buttons!

Buttons are very difficult to use in turbulence, whereas your fingers can grasp and support themselves while turning a knob. For use in an aircraft, a database is a must. I believe a GPS or Loran without an aircraft-type database is of rather limited usefulness.

The GPS antenna works fine inside the fuselage which is a big plus. It does not have to be installed on the outside like a Loran antenna must be. Also, the ground plane is not critical at all. I mounted mine, a small, flat antenna about 2"x3"x5/8", on a bracket mounted on the foreword face of the F22 bulkhead, under the canard. It works great. The GPS reported accuracy of 0.02nm essentially all the way to Indiana and back. The worst accuracy I saw was 0.04nm! See me at Oshkosh '93 for more information.

Mike Melvill

NEW STEREO INTERCOM

I recently installed a PS Engineering, model PM-2000 stereo intercom and, I must say, it is divine! I have used a Sigtronics stereo intercom since the early days of my VariViggen (1977!). They have worked quite well with the exception of a slow degradation that was not really noticeable until someone who had not been in the airplane for a while noticed how bad it really was.

I had installed a car-type, front loading CD player over a year ago and I was disappointed at the quality of the sound. More than that, the microprocessor in the CD player completely trashed my King Loran so it was either the music or the Loran. I am very pleased to report that the GPS appears to be immune from any interference for the CD player and the stereo sound on our new intercom is spectacular. The PS Engineering stereo intercom has two different modes of listening to the music. You can set it so that the music remains on continually for either or both people, or you can have it fade away each time someone talks in the plane or one transmits out of the plane or the radio receives any transmissions. After the transmission has ended, the music comes back on, not abruptly as in most intercoms (such as the Sigtronic), but ramps up gently to the previously set volume - pretty neat!

The intercom is crystal clear, with a very quiet squelch break. It is voice-actuated but has the best fidelity in the squelch circuit I have ever heard. What with a quality CD player, Bose headsets wired for stereo and the PM 2000 stereo intercom, cruising along on a cross county has taken on a whole new perspective! We literally have as good, or better, a sound system in our Long-EZ than we do in our living room at home!

Mike Melvill

ACCIDENTS AND INCIDENTS
The CP newsletter reports accidents and discusses their conditions and causes, for information purposes, for all operators. We have always investigated accidents in the interest of determining information that we can disseminate to you to prevent recurrence. It should be recognized in our discussion of accident conditions or causes that generally this information is preliminary since it is published before the availability of the FAA accident report.

A California Long-EZ struck a pine tree on short final. The airplane pitched down and crashed. The pilot was killed and the passenger was seriously injured. It was late in the evening and the runway lights were on. The pilot had not flown this airplane at night although he had night experience in certified aircraft.

The NTSB has not yet completed their investigation, but we feel compelled to point out that a night approach over trees to a fairly short runway (3600 ft.) can be very tricky. The "black hole" effect on short final can be very deceptive with little or no visual cues as to altitude. Practice night landings (if you must fly at night!) at airports with clear approaches and long, well lighted runways. Always aim to touchdown about 1/3 of the way down the runway. Do not try to hit the numbers at night.

A VariEze crashed on departure from the Kansas City GIG on June 13, 1993. Since there were a lot of EZ builders and flyers on the field at the time,

a rather extensive investigation was conducted on the spot, not only by FAA/NTSB personnel, but also by several EAA members, all of whom are very familiar with EZs. Tragically, two people died in this accident.

By all accounts, the airplane was refueled some time prior to take-off. The fuel caps on this particular VariEze were not the plans-recommended Brock-type fuel caps. They were the "Thermos" expanding 'O' ring-type. This type of fuel cap requires regular lubrication of the 'O' rings at 25 hour intervals. If this is not done, the 'O' rings will crush and crack and, even though you may have the locking tab down and "locked", the cap in fact will not be locked!

Shortly after take-off, the engine was heard to surge and loose power. The airplane began a 45 degree bank turn to the left. After completing 90 degree of the left turn, the nose began to drop and the aircraft impacted in a ploughed field, 30 degree nose low in a 45 degree left bank.

The investigators located all airframe parts except for the tip of one blade of the prop and the right fuel cap. The next day, parts of the fuel cap and pieces of the wood prop blade were found near the center line of the runway on the airport. This verified the theory postulated by the investigators that a fuel cap had come off and gone into the prop disc, breaking the prop. The resulting heavy vibration probably caused the pilot to pull the power back. For some reason, he elected to try to turn back to the runway. With little or no thrust, a heavy airplane in a steep bank (which causes high inducted drag) simply got too slow to fly and descended to the ground at a high sink rate.

It is too late for the couple in this VariEze but it is not too late for all of us who fly to learn from this tragedy. If you are flying a RAF design and have not complied with the CP advisories recommending you chain your fuel caps to the filler neck - do not fly again until you have corrected this omission. If the fuel cap on this VariEze had a chain to retain it, this accident would not have occurred. Please check your back issues of the CP for more information about chaining the fuel caps to the filler neck. See CP28, pg. 7&9; CP 31, pg. 5; and CP50, pg. 5&7.

Another lesson we should all learn from this accident is the problem of trying to make a 180 degree turn back to the runway while low and slow. A landing straight ahead into the wind (which was 15-20 knots that day) even if near the end of the runway, is much more likely to be survivable than a landing with a 15-20 knot tailwind. Think about it. Assume 100 knots airspeed. With 20 knots of headwind, your ground speed would be 80 knots. Downwind, it would be 120 knots! The kinetic energy in a downwind landing, in this case, is 2.25 times as high as it would be in a upwind landing. This could turn a survivable 15 "G" impact into an unlikely-to-survive 34 "G" impact! This assumes that you have not caused a higher sink rate due to the extra drag in the steep turn!

Please read this accident report and never forget the lessons learned. It is much, much better to land long, into the wind, and roll off the end of a runway at slow speed, even if you have to negotiate obstacles, than to land off field, downwind, at high speed.

A California Long-EZ experienced an engine failure while flying level at approximately 10,000 feet. The ensuing emergency, off-field landing, attempted on a California "dry" lake that was not all that dry, resulted in the nose gear collapsing, the nose digging in, and the aircraft flipping over onto its back. The pilot suffered only minor injuries but the aircraft was badly damaged.

An Indiana VariEze departed after refueling. The control tower operator noticed a fire on the wing trailing edge and notified the pilot, suggesting an immediate return for landing. The pilot put the airplane into a high speed dive while returning to the airport to land - and succeeded in putting out the fire. The left aileron, wing trailing edge and engine cowling were slightly damaged by the fire. The fire was caused by the fuel cap being left off during refueling and fuel syphoning out of the fuel tank onto the hot exhaust system.

There were no physical injuries to the pilot, only his pride was hurt. The airplane required considerable repair before it could be flown again.

A California Long-EZ descended into the ocean at cruise speed without any apparent effort to slow down or flare for a minimum speed touch down. The pilot, the sole occupant, was killed. It is uncertain at this time what caused this tragic accident.

Remember, if a water landing is imminent, put down the nose gear and the landing brake. Touch down under control, wings level, at minimum flying speed. Do not attempt to "stall" it in or to touch down on water at high speed. At least one VariEze has conducted a safe, successful water landing with no injuries and only minor damage to wheelpants and lower cowling.

We will report further on this accident as more information becomes available to us.

Editor's note: In the last 2 newsletters, we did not reported a single accident or incident. Now, in this newsletter, we are reporting five! I know it is summer and the good flying weather is upon us but, please, don't lower your guard. Conduct thorough preflights, check the weather, and fly carefully. Almost all of the above accidents and incidents would not have happened if it were not for a few moments of carelessness - don't let it happen to you!

FUEL PRICES

Have you noticed the incredible disparity in the price of 100 low lead avgas around the country? Right here in southern California, we have 100LL selling for as little as $1.64 (at California City) up to $1.92

(at Mojave) and for $2.50 (at San Diego Lindburgh). At Pittsfield, IL it is $1.50 per gallon!

Before you make your annual trip across the country to Oshkosh this year, you might want to call Fillup Flyer Fuel Finder who will sell you a list of fuel prices nation wide for a very modest cost. This really is a good idea for those of us who fly across the country a lot. Also, perhaps, it will send a message to those FBOs that charge ridiculous prices. Hopefully, the budget priced FBOs will reap the rewards of a capitalistic, free enterprise system.

If you have access to a PC, call the computer line at 1-800-955-7900, 3/12/24/9600 baud 8-N-1. If you do not have a computer, call the voice line at 1-800-333-7900.

EPOXY
RAF continues to look at new epoxy resin systems, as time permits. Hexcel has developed a replacement for Safety Poxy and Safety Poxy II that contains no MDA and no styrene. This epoxy system looks quite promising since it has reportedly almost identical physical properties to the Safety Poxy systems. The mix ratio is also the same as Safety Poxy so the same ratio pumps can be used.

We hope to be able to approve this Hexcel epoxy system soon. Stay tuned.

WANTED
Plans and instructions for the NACA inlet for the Long-EZ. I will pay a reasonable price as well as any copying or shipping costs.

Contact: Lloyd F. Fisher
7130 S. Reed Ct.
Littleton, CO 80123
303-933-7502 (H)
303-971-8826 (W)

SHOPPING
FLUSH, INTERNALLY MOUNTED ANTENNAS
A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a

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BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk. Contact:
Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

CANARD PUSHER DIGEST, 2ND EDITION
Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now it its 2nd Edition. (For a complete description, see CP57). Includes all builder related information from CPs 24-75. The 2nd edition of the Digest has now grown to over 700 pages, and is professionally printed on double sided 8 1/2 x 11" paper from a laser printed master.

Quarterly updates to the Digest are also available. The updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

CP Digest for the Long-EZ (2nd Edition) $75.00
(Overseas orders add $20.00 for airmail)
Annual Update Subscription (4 updates) $25.00
(Overseas orders add $5.00 for airmail)

CANARD PUSHER NEWSLETTERS "ON DISK"
Stet Elliott has also compiled the text of all the Canard Pusher newsletters in electronic format. The set includes all of the Canard Pusher Newsletters, from the very first one published in May of 1974, to the present. The set of CPs is provided in a text only format which should be 100% compatible with any computer word processor you presently use. It is available for either the IBM or Macintosh platforms. A hard disk is strongly recommended since the set contains over five megabytes of textual information!

This product is ideal for anyone interested in reading about the evolutionary development of RAF's canard designs through the years, or for those builders still plagued with the "I know I read it here somewhere!!" syndrome. With one of the inexpensive text search and retrieval programs, text string searches across the entire set of files are a snap.

CPs on disk costs $65.00. Specify disk size, (3 1/2" or 5 1/4"), platform (IBM or Mac), and disk capacity.

For either the CP Digest for the Long-EZ, or the CPs on disk, contact:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-8233

VARIEZE INDEX
Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file) for $24.00. Specify which you would want. This index will be updated annually.

Contact: Bill Greer
811 Cooper Square Cir. #240
Arlington, TX 76013

PLEASE NOTE: Those of you who have the first edition, Bill has improved the indexing of several topics and added more cross-indexing You may find it helpful to get an up-grade.

DEFIANT FLYER
If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's

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letter on his Ford-powered Defiant in the December issue is a case in point. See CP67, page 2 for information on subscribing to the Defiant Flyer.

Seen at Oshkosh. Beautiful leather seat cushions (also available in various fabrics) for Long-EZ, VariEze and Defiant.
Contact: Diana Davidson
Alexander Aeroplane Co.
900 S. Pine Hill Road
PO Box 909
Griffin, GA 30224
404-228-3901

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for

builder installation of an aluminum flat stock electrical panel.
$40.00
Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	39.00
Go-A-Long-EZ	39.00

NEW FOUR PIPE EXHAUST SYSTEM
Nat Puffer has designed and tested a new exhaust system for his Cozy. He tells us it will fit any pusher, including a VariEze or Long-EZ. There are slip joints at the flanges to prevent cracking and stainless springs are included to retain the exhaust headers into the short slip joints. These exhaust systems can be ordered directly from the manufacturer:

Custom Aircraft Supply
1318 Gertrude Street
San Diego, CA 92110
619-276-6954

$500.00 includes shipping, handling and packaging.

Nat has had good luck with a heat muff wrapped around both #2 and #4 exhaust headers. There may, or may not, be enough room in an EZ cowl to do this.

FOR SALE
AIRCRAFT COVERS
Custom cover for your Long-EZ. This neat design completely covers your prop, canopy and nose and only uses two straps. Made from space-age Evolution 3 material. Reasonable price.
Contact: Tony Brazier
PO Box 6478
Ocala, FL 32678
904-237-1811

NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.
Contact: Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

NEW PRICE
SIGHT GAUGES
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $35.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

THE "BEAD BUSTER"TM
If you have ever tried to remove a tire from a 500x5 wheel you will understand what a neat tool this is. (Mike purchased one of these tools and wonders how he ever got along without it!) Designed by a Long-EZ builder who became frustrated by this problem, the kit consists of a canvas pouch, a vulcanizing patch kit, cadmium plated fulcrum lever and base, and the heat treated aluminum "Bead Busting" shoe - $75.00.
Contact: Tom Caughlin
10958 National Blvd. #1
Los Angeles, CA 90064

Prop for 0-320 Long-EZ - Hendrickson w/rain leading edge - drilled for 1/2" bolts. - -$450.00

Long-EZ seat cushions, front & rear - New. Light grey - -$195.00

Lightweight alternator assy. - 14v, 40 amp. - complete set-up (mount, split ring pulley, belt, regulator) - for Lyc. without starter/ring gear. - $195.00.

United International airspeed indicator, 3-1/8" - TAS dual scale, 0-210kts.-for Long-EZ. - $125.00
Contact: Dick Rutan at Voyager Aircraft
805-824-4608

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

ALL RAF DESIGNS - Secure fuel caps to fuel filler necks before next flight..

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

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HOMEBUILDER RESPONSIBILITY

Reading through Rex Taylor's "Dragonflyer" newsletter #17, we noted an excellent article covering homebuilder responsibility. We would like to reiterate on this because we believe that you, the homebuilder, should be aware of what you are taking on when you build you own aircraft.

The FAA has set up the Experimental Amateur built category (thanks mainly to the EAA) to allow an individual to design, build and fly his own aircraft. The FAA lists that individual as the manufacturer. As the manufacturer, the builder is entirely and totally responsible for that aircraft. The builder has passed judgement on the quality of workmanship and he alone has made the decision that each and every part that he has put into that aircraft is, in his opinion, airworthy.

A lot of builders are under the mistaken impression that the FAA inspector will guarantee that the aircraft is airworthy when he inspects the aircraft and issues an airworthiness certificate. The FAA does not decide your aircraft is airworthy, you do.

For this reason, every builder should become involved with the EAA. Join your local EAA chapter. Attend their monthly meeting, talk with

other EZ builders. Many good books are available from EAA. Supplement you plans with a few, such as Tony Bingalis' "Firewall Forward". After you have got something built, get as many people as you can to look over your work. Don't be embarrassed. If someone critiques your work, take a strong look at it. If it is not right, throw it out. Your best assurance of success is to adhere strictly to the plans and to build it from the correct materials. In order to be positive that you are using the correct materials, buy them from only the recommend suppliers.

The same philosophy is also true for engines. Almost daily, we receive calls or letters from builders wanting to substitute some wizz-bang engine for the recommended one. RAF can not ethically recommend an engine we have not installed and tested. For the Long-EZ, we recommend any model of the Lycoming 0-235. If you wish to install some other engine please do not call us. We can not help you. As an experimenter, you can, of course, use any engine you want to. You should be aware that you will be involved in redesigning engine mount structure, cooling may not be adequate and you will be testing an unknown when you fly your airplane. You should expect surprises.

If you want a reliable cross country airplane, do yourself a favor and buy a real aircraft engine such as a Continental or Lycoming. These engines have literally millions of hours of field testing on them and have a proven record of reliability.

You, the builder, have the sole responsibility to produce a safe, reliable aircraft. Take that responsibility seriously. The bottom line is this: The designer has absolutely no control over what materials, power plants, etc. go into your aircraft. No control of quality of workmanship and no opportunity to inspect work or materials and, therefore, cannot be responsible for your actions. Most designers will do everything in their power to ensure your success with one of their designs, since problems are just plain bad for business. The best advertisement for the designer is an airplane that does what the designer said it would and a builder/pilot who is happy with what he builds.

(ED: Eight and a half years later and these words are still true.)

CP76, Page 11

GRAPH OF LIFT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

GRAPH OF SINK RATE, LONG-EZ FULL SCALE TEST, OMITTED

GRAPH OF DRAG COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

CP76, Page 12

GRAPH OF MOMENT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

See pages 2 and 3 in this CP for article "Truck-EZ Test.

CP76, Page 13

PHOTOGRAPH OMITTED. PHOTO CAPTION GIVEN BELOW
Donald Douglas lent us his beautiful plans-built Long-EZ so that we could generate the full scale, angle-of-attack data using this "Truck-EZ" rig. Many thanks, Don.

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 77.
VariViggen (2nd Edition), newsletters 18 to 77.
VariEze (1st Edition), newsletters 10 thru 77.
VariEze (2nd Edition), newsletters 16 thru 77.
Long-EZ, newsletters 24 through 77.
Solitaire, newsletters 37 through 77.
Defiant, newsletters 41 through 77.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: RUTAN AIRCRAFT IS OPEN TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every effort to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

WHAT EVER HAPPENED TO OCT. CP?
The October 1993 edition of the Canard Pusher did not make it to the printer. There were two reasons for this: We were very busy with a flight test program at Edwards Airforce Base and, we had very little material for CP 77 (Oct.). All subscribers will have their subscriptions extended so you will still receive the same number of CPs.

If you have any subject you feel would be of interest to other builders/flyers of RAF designs, or one of a safety nature, please send them in. This newsletter is your newsletter. In order to keep it alive, we need feedback!

FLASH!

Unofficial, 2000 kilometer, closed-course speed record set by Dick Rutan flying Burt's Catbird in the C1-B weight class (1000 kg/2204 lbs.) on December 20, 1993.

Dick took off from Mojave and completed a flight from the Lake Hughs VOR to the Boise, Idaho VOR and back, a distance of over 1087nm (2013.5km) in 5 hours and 6 minutes. Unofficially, and subject to ratification by the FAI, that is an average speed of roughly 245mph. The old record was held by Jeana Yeager flying Dick's Long-EZ at 204mph. Congratulations, Dick and the Catbird.

ANOTHER CLOSED COURSE WORLD RECORD
"Ontario Approach, this is VariEze N99VE, 25 miles east of Homeland VOR at 10,500 ft. Request transition to Homeland for a 180 turn."

"VariEze N99VE, Ontario Approach. We've been waiting for you. Approved as requested. Will call your turn."

Two hours down and 14 more to go, I thought. All of that planning over the past 3 months is paying off. Fuel consumption and time are better than planned, the air is smooth, no significant wind, and the moon is full. Couldn't ask for better conditions. Looks like a go for the record....

It was almost ten years ago on the weekend of July 14 and 15th, 1984 that Jeana Yeager set the same

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closed course world's record for aircraft weighing between 661 and 1102 pounds in the same aircraft, N99VE. Jeana circled a course from Bakersfield, CA to Merced and back for a total of 8 laps and 2428 miles. Several hours later I followed up with a distance over a straight line departing Mojave, CA and flying non-stop to Martinsburg, WV just west of Washington, D.C. for a total of 2214 miles - two records in one weekend. Turning 50 this month, and needing a mid-life crisis thing to do, nothing seemed more appropriate than to test all the improvements I have made to the plane and getting both distance records in my name. In each of the old records, the plane had averaged about 150 mph and 50 miles per gallon. Since the fully loaded take off weight was right up against the maximum of 1102 pounds allowed for the class, my weight over Jeana's meant that I would be carrying about 10 gallons less. Aircraft improvements since that time had to make up for the difference.

Since 1983, I have been very active in the CAFE 400 events, taking my share of trophies like those shown in the October '93 Sport Aviation article. To be competitive with people like Klaus Savier in his very efficient and fast VariEze and Gene Sheehan with his highly refined Q200 prototype, took some dedicated effort to constantly modify and test, looking for every last knot of speed and efficiency. Major changes since the original records are the addition of custom designed high compression pistons for the Continental A65, lower drag wheel pants replacing the original "football" shaped pants, an Ellison throttle body injection carburetor, a modified oil tank and induction system to accommodate a low drag cowl, and an electronic ignition

supplied by Light Speed Engineering with manifold pressure regulated spark advance.

Getting Ready

After I finish a typical modification, I try to gauge how much effort was expended for the speed gained; some mods are more successful than others. The wheel pants are perhaps the highest payoff of any mod to date adding about 5 knots to my top speed. The pants are carved from a single block of foam with a top planform using a 65-025 symmetrical airfoil. The side view is driven by the requirement for a constant pressure distribution at each station down the pant. To achieve this, the angle that the top and the bottom of the pant make with the waterline is the same as the angle that the left and right side make with the line of flight. All of the flow lines appear laminar, traveling straight aft without curling back. A plug and female mold were made on which two layers of glass were laid up to give a weight of about 1 1/2 lbs. per pant.

The original A65 was designed with 6.5:1 compression in the days when fuel for general aviation over 80 octane wasn't readily available. It is well known that the thermodynamic efficiency of a piston engine increases as a function of compression ratio. After several iterations (some not so successful), I designed and had constructed by a custom automotive piston manufacturer, a set of forged pistons with a 9.0:1 compression ratio. Also, I installed a set of modern technology automotive rings with a 3-piece oil control ring and Total Seal gapless 2nd compression ring. As a result, I average about 25 hours per quart of oil and have a very low idle manifold vacuum reading of about 7 inches. Crankcase blow-by is almost nonexistent.

The Ellison throttle body injection unit has become a familiar piece of equipment in the homebuilding community. The ability to lean much beyond a conventional carburetor and still run smoothly gives nearly a 10% savings in fuel consumption. The Ellison is mounted horizontally in front of the oil tank to allow the installation of a low profile cowl. The induction tube passes through the tank and exits at the distribution spider. The induction air heating lowers volumetric efficiency somewhat (reduces maximum power) but provides a longer mixing length to give better fuel distribution prior to reaching the spider. Since efficiency is the primary goal, the trade off was worth it. Also an added benefit of oil cooling eliminates the need for an oil cooler.

Over the years, I have had three different engine cooling systems on the airplane. When originally built, being convinced that Burt's way was the only way, I installed a conventional EZ pitot cooling scoop. Since that time I have had the flush NACA scoop, and now the "arm pit" scoops. The arm pit scoops show a slight advantage over the flush scoops, but this is one of those modifications where the speed increase per hours spent is very poor. The place where this

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modification is a real winner is in the way it looks and how it cools the engine. Head temperatures in cruise are in the 260-280F range.

Many other aerodynamic cleanup changes can be classified as attention to detail; such as fairings and leak sealing, contribute to the overall efficiency.

The standard magneto is designed with fixed timing to give detonation-free operation during worst case operation (maximum power, hot day, sea level condition). At high altitude, where conditions are cool and power is reduced, the optimum ignition advance is considerably higher to account for a much slower flame travel within the combustion chamber. The light weight electronic ignition supplied by Light Speed Engineering replaces one of the magnetos with an electronic processor and a set of ignition coils. The system senses manifold vacuum and adjusts spark advance up to a maximum of 17 degrees above the nominal setting. The effect of this advance is dramatically illustrated at altitude by noting a 50 RPM drop switching from the full advanced setting of 43 degrees back to the nominal setting of 26 degrees.

All of these efforts to increase efficiency have also paid off in speed. When first constructed, the plane would not quite reach 180 mph. Recently, at an EZ racing event held at Wendover, NV over the Bonneville salt flats, the airplane turned 204 mph on a 125 mile triangular course. Not too bad for a two-place plane with 170 cubic inch displacement engine at 7000 ft. density altitude.

Flying The Record

I had not given much thought to going after a second record and was even unsure that the aircraft had the capability of breaking the existing record until I received encouragement from Dick Rutan at this past year's Oshkosh event. On the trip home, I started doing some serious data taking. Calculations confirmed that indeed the aircraft had the range necessary to beat the old record if the empty weight had not crept up over the years. To my surprise, my attention to weight additions had paid off. The empty weight with auxiliary fuel tank installed was about 10 lbs. more than at the time of the previous record attempt, more than accounting for all those "essentials" such a LORAN and autopilot. I contacted Art Greenfield of the National Aeronautical Association (NAA) and received a package of all the forms necessary to sanction and certify a World's Record. Turnpoint verification can be accomplished by either a NAA certified observer or the FAA. I chose the FAA route and contacted the Approach Control people at both Phoenix and Ontario, CA. Both groups were delightful to work with and anxious to help in any way they could. I sent the forms for turn point verification that they were to fill out at each passage. The NAA, the United States certifying authority of the Federation Aeronautique Internationale (FAI), requires that an NAA observer must witness the aircraft weighing, barograph installation, gas tank sealing, takeoff, and landing. Klaus Savier, who is an NAA member and the present record holder for the 1000 and 2000 kilometer speed records in his VariEze, filled the requirements for a qualified observer.

Planning for the right time takes a little bit of common sense and a lot of luck. Since part of the flight occurs at night, I wanted the moon to be as full as possible in case an off-airport landing would be necessary. On the weekend of October 30/31, the moon was at its full brightness. The closed course turn points of Chandler, AZ and Homeland VOR on the eastern edge of the LA basin were chosen for the flat, low

altitude terrain and the safety of paralleling Interstate 10 the entire route. As the time approached, the Santa Ana conditions that fanned the fires in the LA area were developing. The airplane gods were smiling, and what was supposed to be peak wind conditions all weekend actually turned out to be light and variable to 10 knots from the south at altitude.

Klaus flew to Phoenix in mid-afternoon on Saturday the 30th to help with final preparations of the airplane. We fueled up, less an anticipated 4 gallons and parked the plane. I went home to try to get some sleep. After a largely unsuccessful attempt to rest, I got dressed with borrowed ski pants, down booties and a warm coat. Leroy Castle, a local EAA member and keeper of the Arizona EAA Council platform scales, showed up at the airport at about 9 pm.

After rolling N99VE onto the scales, I climbed in with all the equipment that I would eventually

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take off with. After adding the necessary fuel to bring the total weight up to the 1102 pound class limit, Klaus sealed the tanks. Total fuel on board was calculated to be 49.3 gallons. My conservative "how-goes-it" chart said that I would need 48 of those gallons to make it four times around the predetermined course for the record. At 10:50 pm, I departed into the night for Homeland VOR. The rest is history. The plan went off without a hitch. Fuel flows, engine temperatures and all the electronics worked flawlessly. At each turn point, I exceeded my anticipated times, speeds and fuel flows. Taking data with a calibrated fuel flow meter at each point, I generated the following summary: **CHART OMITTED**

After all the concern for adequate margin, I landed with almost 7 gallons of fuel on board or almost 400 additional miles possible. At this writing, all the paperwork has been submitted for final approval by the NAA and FAI.

Gary Hertzler"
ED. Congratulations, Gary, attention to detail is everything! 58-1/2mpg at 157mph - WOW!

A DIFFERENT CONTOUR/FINISHING IDEA
This is presented as food for thought, not as the only way to do it. This idea was developed by Cory Bird, a very bright manufacturing engineer at Scaled. Cory is in the finishing stages of his exquisite original design and came up with this idea while working through the contouring stages on his airplane. I recently refinished my wood core/carbon composite prop and I used Cory's idea and I liked it! It worked great! Here it is.

The idea came when Cory compared the weight of a gallon of epoxy with a gallon of Featherfill. If you have not done this, do it, it will open your eyes! Even taking into account the evaporation of solvents in the Featherfill, there is a huge difference. Anyway, this is a process that starts when you have your airplane (or parts of airplane) structurally complete, in bare glass, and are ready to begin

contouring. Sand the glass as usual, you are not looking for a structural bond such as you would need in a glass-to-glass bond, you just need to scratch the cured epoxy. Use at least 40 grit, 36 grit is better. Sand hard in one direction 10 strokes. Then sand hard at 90 degrees to the first sanding in the same area, 10 strokes. This is not a hard and fast rule, it is just a rule of thumb so that you can begin to see the kind of surface preparation you need prior to applying dry micro.

Before applying the dry micro, paint the area with pure epoxy. Wipe as much of this epoxy off as you can with a clean paper towel. This is the "glue" that will bond the dry micro to the cured substrate (skin). A good idea here is to only try to do a small area at a time, say a square foot or two. Mix up a batch of dry micro - the consistency of cake icing works well. Some people try to mix it so dry that it is almost impossible to apply. I don't agree with that. The gram or two of weight you might save per 8 ounce cup is simply not worth the enormous effort. Spread the micro (just like peanut butter) using a squeegee. If it rolls up behind the squeegee, it is a little dry but you can fix that with peel ply. Squeegee through the peel ply to get the micro even and where you want it. Once the whole surface is micro'd, allow it to cure.

Contour sanding should be done using a long sanding block. In the case of a wing, 3 or even 4 feet is not too long. Glue 36 grit sandpaper to the sanding block using 3M 77 spray adhesive. Sand until you hit glass, then stop. If you still have low spots, rough them up, fill them with dry micro and repeat the above until you have the smooth contour you like. Leave it in 36 grit scratches. Do not go to a finer grit sandpaper.

Now, mix up a little pure epoxy and, using a 6" wide soft rubber squeegee, spread this pure epoxy (no micro) all over the surface. The idea is to fill all of the 36 grit scratches with pure epoxy. Carefully squeegee as much of this first coat of epoxy off as you possibly can. Use a lot of force on the squeegee and wipe the edge of the squeegee often with a paper towel. Allow to cure for two hours or so. The first coat should be gelling but not fully cured when the second coat of epoxy is applied in exactly the same way. Continue with this ritual until you have applied five separate coats. At two hours per coat, obviously you will need at least 10 hours at one stretch. Of course, this will depend on the ambient temperature and on what epoxy you are using. Here in Mojave in the summer, using Safety-Poxy or PTM&W epoxy, two hours between

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coats is sufficient. Allow these five coats to cure for a full 48 hours.

At this point, you have filled all of the 36 grit scratches and you have a very thin film of cured epoxy over the entire surface. All that remains now is to final sand. You should not have any runs or thick lines of epoxy. Wet sand with 220 grit followed by 320 wet. You are now ready to paint! That's it, no Featherfill, no Morton's eliminator, nothing but epoxy all the way. This way, there are no pinholes, no

voids, no place for a delamination to start, no place to trap moisture. All you need now is a quality paint. I would suggest at least a high quality urethane or epoxy paint. Keep in mind that your composite airplane is very flexible and will flex in turbulence and while taxiing over bumps. If you use a brittle paint such as enamel or lacquer, it will crack at all highly stressed areas.

For the toughest, most longlasting finish, you should use the same epoxy for the contouring method described here as you used to manufacture your airframe. However, this may be time consuming because sanding Safety-Poxy micro can be very hard work. The only way to speed this up, for those of us who are impatient, would be to use the fast West System (Gougeon Bros.) for the contour job. It will go much quicker, perhaps only one hour between coats, and it will sand much more easily - it will not be quite as tough, but it will certainly be adequate.

I would appreciate any feedback from anyone trying this system. - ED.

TIRE WEAR
Over the years, we have seen EZ's, Defiants and even Viggens with horrendous wear patterns on the tires. Regardless of the original main wheel alignment method used during construction, in the final analysis, the wear pattern on the tires tells it all.

Ideally, the main tires should wear evenly across each tire. They should not wear on the outside or inside shoulders. If your tires are wearing unevenly, fix the problem, don't just accept it as inevitable. If the rubber tread is wearing heavily on the outside shoulder, you have too much toe in. If the inside shoulders are wearing badly, you have too much toe out. To correct both problems, install aluminum taper shims as required between the axle flanges and the main gear strut. These taper shims are available from several sources including Aircraft Spruce and usually come in 1/2, 1 and 2 degree increments. These may be combined to give greater tapers if required. (They can be installed so as to remove excess camber as well, if required.)

We have found that it can take several iterations to finally achieve the even tread wear that is most desirable, but it can be done. Give it a try.

CAUTION: FOD TO PUSHER PROPS
Foreign object damage to your EZ prop, such as a nick or gouge that you might tend to believe was gravel thrown up by the tires, probably is not from the tires at all but most likely is caused by something that fell out of the cowling (off the engine!). My 2100 hours of Long-EZ flight and over 700 hours of VariViggen flight have proven to me that almost invariably a ding in the prop, especially if inboard of 10 inches from the tip, was caused by something coming out of the cowling. A clipped end of safety wire, a washer, a nut, even a bolt and once an exhaust stud, nut and washer! My experience has shown that gravel/sand particles thrown up by the nose tire does cause tiny chips in paint and wood predominantly near the tips of a prop (the outboard 10 inches or so). The main tires seldom, if ever, cause anything to be thrown into the prop arc.

The point I want to get across is this: Any damage to your prop, heavier than sand and light gravel chips and generally inboard of 10" from the tips, is almost certainly caused by something falling out of your cowling and possibly off your engine. Do not ignore this type of damage, even if the prop damage is minor. Ground the airplane - remove the cowl and use a good flashlight to carefully and methodically check for missing screws, nuts, bolts, etc. You will be amazed how often you will find something missing. Over time, you will learn to be more careful about casually clipping a piece of safety wire and having it lodge in a wiring bundle on the firewall. Same goes for a dropped washer, nut or bolt. If it does not fall all the way to the ground - know that it lodged somewhere and will go into the prop disc

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sometime. With time, you will become an expert at finding lost washers in wing roots or in wiring bundles. Remember, the airplane will always try to warn you before it bites you! An unexplained ding in a prop blade is a warning! Pay attention - Fly safely. - ED.

EPOXY UPDATE

The dust is beginning to clear after the initial confusion caused by the State of California making the use of MDA illegal, at least, in the industrial environment. Since Scaled Composites does not subject its employees to MDA or styrene (contained in Safety-Poxy) RAF reasoned that homebuilders should have the same benefits. A lot of frantic testing was conducted and, as a result, PTM&W (PR2770/PH366C) was recommended. Many builders complained about the workability of this rather thick (viscous) epoxy system so the tests and evaluations continued. Today, we have an improved, thinner PTM&W (PR2032/PH3660) which has even better physical properties than the original PTM&W and we have Hexcel's 2427 system which has the advantage of using the Safety-Poxy ratio pump "as is"., that is to say, the mix ratio is 44:100. The workability and "wet out" qualities of Hexcel 2427 are excellent and the physical properties are adequate.

Caution: Both of the above epoxy systems have higher exotherm problems than Safety-Poxy. The only place this can cause a problem is when you join foam blocks. The is very important. You cannot have a micro joint between two foam blocks any thicker than 1/8". You must be absolutely certain that your micro joint, or the space between the foam blocks, is less that 1/8" (1/16" is best). Any more than 1/8" will cause an exothermic reaction, due to the high insulating properties of the foam, and serious damage to the foam and loss of structural integrity of the foam joint will result.

This is not as good as Safety-Poxy (which allowed a safe foam block joint up to 1/4" thick), but both of these epoxy systems are completely free of MDA (a known carcinogen) and styrene (highly allergenic). Soooo..... you have your choice.

Please let us have your observations as feedback for the CP. We, and all of our readers, are interested to hear about personal experiences, good and bad!

LETTERS

FROM CHARLIE PRECOURT, VARIEZE BUILDER/FLYER, ASTRONAUT.
"Dear RAF,

I've sent along some info I hope will make good inputs for the upcoming newsletter. You'll find a photo of my launch on the Columbia in April and a couple of other shots we took from orbit. The launch is an impressive ride to say the least! In the photo, the tail of the orbiter has just cleared the tower level (couple hundred feet) and our speed is already over 100 mph vertical. There are 7 million pounds of thrust and our liftoff weight is just under 5 million pounds! First stage is quite a rumble - about like a freight train - and the thrust gives you a relentless, increasingly hard push into the back of your seat - to just under three g's at booster burnout. That's not a lot of g but it's a long duration at that g level so you really get a strong sense of the rapid acceleration. After booster separation, the ride smooths out and the g level drops off until the fuel weight starts to decrease as the tank empties. We hit 3 g's again at about the 7 minute point in ascent and stay there until main engine cutoff at 8 1/2 minutes where we hit orbit at a speed of 17,500 mph (Mach 25). Zero g is immediate after the engines cutoff. Some folks may recall that our initial attempt at the launch resulted in a pad abort as our right main engine failed the start sequence due to a purge valve that failed to close. There were some tense moments sorting out the problem, but the safety system worked as designed and stopped a potential engine burn-through... Once on orbit though, the delays become insignificant. In the grand scheme of things a month delay for the engine changeout and retest was a small price to pay to ensure a safe and very productive mission.

We were a spacelab mission that conducted over 90 different experiments in medicine, biology, robotics, materials sciences, (crystal growth and metallurgy - using furnaces to melt and resolidify a variety of materials in the absence of gravity which enhances their properties -- I'd like to try a fiberglass layup in zero g

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sometime!!). We had a laboratory setup that included some 8 furnaces, over a dozen laser devices, a medical diagnostic rack that had ultrasound, EKG and EEG devices - you name it. One experiment in fluid physics actually verified a process empirically that up 'til now had only been a theory in the textbooks. So all in all, we had a great flight in terms of scientific return. In the medical research area, a very promising research in cell fusion (genetic engineering) was also completed. In the absence of gravity, cells of different types can be fused using electric fields without damaging the cells (without gravity you have no perturbing forces that damage the cells during fusion like you have on earth). The result is the ability to produce hybrid cells with very high quality characteristics. One day this technique may allow us to design cancer killing cells or cures for other diseases.

The most rewarding aspect of space flight personally, though, was viewing the earth. It is nothing short of incredible. Those are some of the most precious moments of a lifetime and I wish I could have somehow had my family there with me to share it. When we travel to

talk about our spaceflight experiences, we're often asked if the experience changed us in any way. Some have even called it a religious experience but I like to describe it more in terms of gaining a new perspective on our place in the universe. You witness first hand and on a grand scale the awesome power of nature. At any one moment you can view an area that is approximately 1000 miles across the face of the earth - further than that you lose detail at the horizon - and the speed of the orbiter is such that you see an entirely new 1000 mile area every three minutes and twenty seconds! When you take in the view of a sandstorm blowing out of Africa across the Atlantic that covers over a thousand miles across or watch lightning continually going off under you on the night side of the earth, you really get a new perspective of how powerful nature is. I used to think our machines were pretty powerful - I've flown my VariEze coast to coast several times and I've flown F-15's across the Atlantic on deployments and now I have ridden several million pounds of thrust to orbit. We speak in terms of big numbers when we talk about the power of our machines, but when you see how little you are from the perspective of viewing the earth from orbit, you realize how insignificant you are as an individual against the power of nature. You also realize that your seven million pound thrust machine is nothing more than a speck of dust revolving around a planet that itself is just a speck of dust in the universe. So when you combine that with the view of an earth without visible borders or political boundaries, you see that it is only the teamwork of thousands of people that allows us to harness our little piece of nature! If only we could take the people fighting in Bosnia, Haiti or Somalia to orbit to see where they come from - I don't think there would be nearly as much conflict on earth.

Speaking of Somalia, I've also put in a photo of that country that shows the horn of Africa, the Gulf of Aden and off on the horizon Saudi Arabia. The colors are incredible and in person the view in 3D is mind boggling. You can't float by a window on orbit without being distracted by the view! Finally, I've included a slide showing yours truly floating in the lab module while I was working on an air sampling experiment (sorry I've run out of prints of interior shots for the moment). Nothing beats being able to float, although it makes working with multiple free pieces of equipment or parts kind of tough as they all want to float away. I remember at one point having a couple of items in each hand, something else between my knees and a pencil between my teeth while I was trying to record some data - and then Houston decided to call and I needed to key the mic to answer!

Reentry was a treat as well - we entered on the night side of the earth for an early morning landing at Edwards. As we hit the atmosphere at about 400,000 feet, the heat of reentry (about 2500 deg.) started an ionization of the atmosphere that we saw as an orange-pink glow out all the windows. We're at an angle of attack of about 40 degrees during the hot phase of entry and so out the overhead window you can see down the core of the vortex and plasma trailing behind us which appears as a brightly pulsating, red-orange tail. At about Mach 19, we came into sunrise on the eastern horizon in front of us so through the forward widows we began to see sunlight which was bright enough to overpower the red glow, while out the overhead and side windows we continued to see the glow until we fully slowed below the high heat velocities (down below about Mach 8). We hit the California coast doing Mach 5 and were

finally starting to fly a little more like an airplane. In five more minutes

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we were on final at 300 knots with a 19 degree dive for Rwy 22 breaking through a thin overcast at about 16,000 feet. It was like a homecoming to see the lakebed again, as I had spent 5 years there before joining the space program.

I'm looking forward now to my next flight opportunity as the pilot. This first mission, I was designated mission specialist number 2 (MS-2) who performs duties somewhat analogous to a flight engineer in an airline crew on ascent and entry but who also acts as pilot and shift commander on orbit. I was on opposite shifts from the mission commander on orbit and therefore flew all the orbital maneuvers required during my awake hours to point the science instruments in the payload bay at their intended targets (earth observation cameras, ultraviolet cameras for the study of the Milky Way and our communication antennas that needed to be pointed at satellites). I also had command of the overall operation while the mission commander's shift slept. With a crew arrangement like this, we can operate the experiments 24 hours a day and maximize the science return of the flight... In any event, I hope to fly again towards the end of '94 or early '95 as the pilot for my next crew. Until then, I'm supporting upcoming missions as CAPCOM - the person who communicates with the crew from the control center.

Our future with the shuttle program is now expanding to include the Russians. We have two cosmonauts here in Houston now training for a shuttle flight in January. We are also planning up to 10 MIR (Russian space station) rendezvous flights where we will use the shuttle to change out crewmembers on MIR. Some of our astronauts will begin training in Moscow to fly on MIR and we plan to conduct further research, expanding on what was done on my lab flight, aboard MIR. This is all leading up to our planned joint space station development with the Russians and our European, Japanese and Canadian partners. So, many of us are now also beginning Russian language training. Things have really changed for a guy who used to fly F-15's on the German border - now I walk down the hall in my office and hear Russian being spoken by visiting cadre from the Russian space agency! Let's hope it works!

Mike, I've also enclosed the info about deep stall that we discussed at Oshkosh. I have received permission for public release of the video tape of an F-16 deep stall incident which gives a pilot's -eye view of a deep stall which almost doesn't recover. I've also attached a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall. I've made arrangements with a local video service here to duplicate the tape for those who want a copy. I'll be happy to provide a copy of the tape along with a transcript of the audio portion (for clarity) and my writeup about the learning points to look for on the tape to anyone out there who'd like one. I'm able to do this at cost for $13 a copy which includes the tape, the duping, printing and

mailing. Folks can just mail me a note at my address: 7015 Little Redwood Dr., Pasadena, TX 77505 to get a copy.

Y'all take care, and fly safe!

Charlie Precourt"

ED NOTE: Many thanks, Charlie, for the fabulous description of what most of us can only imagine - what a trip! Also: See ad for tape in the FOR SALE section of this newsletter.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

ALL RAF DESIGNS - CAUTION: EXOTHERM PROBLEMS. SEE ARTICLE "EPOXY UPDATE" PAGE 6 THIS ISSUE.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

SHOPPING

FLUSH, INTERNALLY MOUNTED ANTENNAS
A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without

connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk. Contact:

Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

CANARD PUSHER DIGEST, 2ND EDITION

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now it its 2nd Edition. (For a complete description, see CP57). Includes all builder related information from CPs 24-75. The 2nd edition of the Digest has now grown to over 700 pages, and is professionally printed on double sided 8 1/2 x 11" paper from a laser printed master.

Quarterly updates to the Digest are also available. The updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

CP Digest for the Long-EZ (2nd Edition) $75.00
(Overseas orders add $20.00 for airmail)
Annual Update Subscription (4 updates) $25.00
(Overseas orders add $5.00 for airmail)

CANARD PUSHER NEWSLETTERS "ON DISK"

Stet Elliott has also compiled the text of all the Canard Pusher newsletters in electronic format. The set includes all of the Canard Pusher Newsletters, from the very first one published in May of 1974, to the present. The set of CPs is provided in a text only format which should be 100% compatible with any computer word processor you presently use. It is available for either the IBM or Macintosh platforms. A hard disk is strongly recommended since the set contains over five megabytes of textual information!

This product is ideal for anyone interested in reading about the evolutionary development of RAF's canard designs through the years, or for those builders still plagued with the "I know I read it here somewhere!!" syndrome. With one of the inexpensive text search and retrieval programs, text string searches across the entire set of files are a snap.

CPs on disk costs $65.00. Specify disk size, (3 1/2" or 5 1/4"), platform (IBM or Mac), and disk capacity.

For either the CP Digest for the Long-EZ, or the CPs on disk, contact:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-8233

VARIEZE INDEX

Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file) for $24.00. Specify which you would want. This index will be updated annually.

Contact: Bill Greer
811 Cooper Square Cir. #240
Arlington, TX 76013

PLEASE NOTE: Those of you who have the first edition, Bill has improved the indexing of several topics and added more cross-indexing You may find it helpful to get an up-grade.

DEFIANT FLYER

If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's letter on his Ford-powered Defiant in the December issue is a case in point. See CP67, page 2 for information on subscribing to the Defiant Flyer.

Seen at Oshkosh. Beautiful leather seat cushions (also available in various fabrics) for Long-EZ, VariEze and Defiant.

Contact: Diana Davidson
Alexander Aeroplane Co.
900 S. Pine Hill Road
PO Box 909
Griffin, GA 30224
404-228-3901

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE
NEW ITEM
VIDEOS AS MENTIONED IN CP76.

We now have available VHS tapes of two of Burt's talks at Oshkosh '93.

Tape #1 - Design College - Cockpit of the Future.
Tape #2 - RAF Builder's Support Forum.

Please send $20.00 per tape to RAF at 1654 Flight Line, Mojave, CA 93501. We will pay the postage.

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	39.00
Go-A-Long-EZ	39.00

FOR SALE

F-16 DEEP STALL INCIDENT VIDEO
Gives a pilot's-eye view of a deep stall which almost doesn't recover. Includes a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall, as well as a transcript of the audio portion (for clarity).
Price - $13.00.

Contact: Charlie Precourt
7015 Little Redwood Dr.
Pasadena, TX 77505-4433

AIRCRAFT COVERS
Custom cover for your Long-EZ. This neat design completely covers your prop, canopy and nose and only uses two straps. Made from space-age Evolution 3 material. Reasonable price.
Contact: Tony Brazier
PO Box 6478
Ocala, FL 32678

904-237-1811

NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.
Contact: Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

NEW PRICE
SIGHT GAUGES
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $35.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

ORIGINAL REM 37 BY SPARK PLUGS. These are the short ones available up to mid 80's. New - $17.00 ea.

They were the "thermos" expanding "o" ring-type. This type of fuel cap requires regular lubrication of the ''O' rings at 25 hour intervals. If this is not done . . . . .

Contact: Steve Franseen
303-987-1880 (leave message)

FOUR STACK STAINLESS EXHAUSTS
Further update on the all stainless steel 4-stack exhaust pipes. They are now available with springs and slip tubes at the flange or with ball joints, builder's choice, each still has the original slip tube support on each side to keep the pipes totally independent of each other. They have 1/4" type 321 stainless steel flanges and type 321 .035" stainless steel tubes. The tubes are "degreased" inside and out before they are purged or back-gassed with argon while being welded (others don't do these two very important steps). They fit Lyc. engines for any pusher aircraft, Ez's and Cozys, etc. - Cost - $500.00 plus $15.00 shipping and handling.

Also, if anyone would like to have ball joints fit and welded on their existing pipes, the cost is $150.00.

The RAM AIRBOX is still available at $325.00. Reuseable foam air filter - $20.00 plus $11.95 shipping and handling.

The increase of performance of both 4-stack exhaust pipes and airbox combination is very impressive, about 200 rpm on the average Long-EZ

installation. Builders can call or send SASE for a flyer. Both items come with an installation sheet.

Contact: Hal Hunt
6249 Longridge Ave.
Van Nuys, CA 91401-2528
818-989-5534

HARD TO FIND BELLCRANK BEARINGS
Bellcrank bearings for control systems are now in stock again. Due to a nation wide shortage, Wicks has contracted with a local manufacturer to provide a s many as needed. They just received 5000 of the BC4W10 bellcrank bearings which are used on many experimental aircraft.

THE LASTEST IN LAMINATING EPOXY
In stock - a large supply of the newest laminating epoxy available. PTM&W Industries 2032 Epoxy Resin and 3660 Hardener is designed for all types of structural applications and for all your laminating needs.

PTM&W Industries, working with respected aircraft designers, has developed this new epoxy laminating system to be the safest to use, and to have the best chemical adhesion on fiberglass, carbon fiber, Kevlar, etc.

Contact: Wicks Aircraft Supply Co
Bill Weder
618-654-7447 or
1-800-221-9425 for a free
catalog.

WANTED

Original (or later) Lexan or Plexiglas VariEze Landing Lite nose tip cover.

Contact: A. McPherson
PO Box 195
Stewarts Point, CA 95480-0195
707-785-2947

Plans for NACA inlet for Long-EZ. Will pay reasonable price plus shipping.

Contact: Klay E. Gilbert
PO Box 307
Lindsay, TX 76250-0307

DOES RAF HAVE A COZY RELATIONSHIP?
It has recently come to our attention that a statement printed on the cover of the COZY Mark IV plans is creating an impression that these plans or this aircraft may have been approved by Burt Rutan or by Rutan Aircraft Factory. The aircraft and the plans for the aircraft have NOT been approved by Burt Rutan nor have they been approved by Rutan Aircraft Factory.

The reason that there is any agreement at all with the CO-Z Development Corporation is because Nat Puffer (unlike others) came to RAF in the

early 1980's and agreed to pay a royalty if we allowed him to copy and publish portions of the Long-EZ plans for developing his original Cozy design. At that time we considered that, at a future date, we might assist him by testing the Cozy and possibly testing his future designs. However, RAF decided it could not provide the same controls over the design, therefore, the same safety program we provide to Long-EZ builders/flyers would be unavailable. Consequently, RAF never evaluated nor approved the Cozy or any other Co-Z program.

This does not infer that there is anything wrong with the Cozy or with any of Nat's other designs, only that RAF has never tested them and, thus, cannot comment on their suitability or safety.

Any statement found on any document from CO-Z Development Corporation relative to RAF's agreement represents only that CO-Z Development has full permission to use structural and manufacturing technologies that were developed for the Long-EZ. There is no approval or implied approval by RAF regarding the suitability of CO-Z designs.

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GRAPH OF GARY HERTZLER'S VARIEZE FUEL FLOW OMITTED

CP77, Page 13

PHOTOGRAPH OMITTED. PHOTO CAPTION GIVEN BELOW

Somalia on the Horn of Africa as seen by Astronaut Charlie Precourt, VariEze builder/flyer, from Spacecraft Columbia, April 1993. Photo by Charlie Precourt.

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THE CANARD PUSHER No 78 Apr & July 94

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Back issues	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 78.
VariViggen (2nd Edition), newsletters 18 to 78.
VariEze (1st Edition), newsletters 10 thru 78.
VariEze (2nd Edition), newsletters 16 thru 78.
Long-EZ, newsletters 24 through 78.
Solitaire, newsletters 37 through 78.
Defiant, newsletters 41 through 78.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: RUTAN AIRCRAFT IS OPEN TUESDAY ONLY FROM 8:00 TO 4:00. When you call on Tuesdays, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

ANOTHER RECORD FOR BURT'S CATBIRD
As reported in Sport Aviation in April, 1994, Mike Melvill has set an unofficial world record for FAI Class C-1C (2204 to 3858 lbs.) over a 2000 kilometer closed course. He tried twice before he succeeded. The first attempt was going very well when the overcast decided to come on down. In only a few minutes, he picked up enough ice to slow him down 17 miles per hour! It was obvious he could not break the record so he aborted the attempt and returned to Mojave.

A few days later, the weather was perfect and he covered 1087.2 nautical miles in 4 hours and 52 minutes for an unofficial speed of 223.28 knots (257 mph). The old record was 242.22 mph and was set by Ed Miller in a Piper Malibu. That is one fast Catbird! Confirmation from the FAI is expected soon.

BURT'S TALKS AT OSHKOSH

FRIDAY - JULY 29
10:00am - Tent #3
LIFE, THE UNIVERSE AND EVERYTHING ELSE
1:30pm - Museum
VOYAGER

SATURDAY - JULY 30
8:30am - Design College
SEATING ARRANGEMENTS AND OTHER DESIGN ISSUES
10:00am - Tent #3
TENT TALK SHOW

SUNDAY - JULY 31
10:00am - Tent #3
BOOMERANG AND THE COMPUTER COCKPIT

WES AND MILLIE GARDNER, APRIL 1994
Wes and Millie were very good friends and will be sorely missed by all who knew them. On Monday, April 4, 1994, Wes took Millie for her first ride in their recently completed E-Racer. After only a few minutes, Wes called that he had a problem and was returning to the airport. Sadly, he did not make it and they were both killed in the crash.

Several mutual friends have investigated this accident and have reported a consensus that the throttle linkage separated, allowing the engine to return to idle. Unfortunately, idle power was not enough to allow them to return safely to the runway.

All of you who had met Wes knew him to be a regular at the Jackpot, Wendover and Kanab EZ races. He was a truly dedicated and extremely competitive pilot and loved racing of all kinds, including boats and cars. He was one of the first to fly with an Ellison throttle body and an electronic ignition system. His VariEze was not only beautiful, it was very fast! Wes set the fastest time at the Flying Kilometer in Chandler, AZ in 1990 and he was thrilled!

Wes and Millie were some of the kindest, most generous people we ever knew - until we meet again, fly high and fly safe, Wes and Millie.

ENGINE CONTROLS
We have talked about this subject several times over the years yet many builders continue to do less than their best work in this area. Pay close attention, Guys: Your ability to control your engine is second only to your ability to control your airplane. You do your very best work on the pitch, roll and yaw control system and you should do the same for the throttle and mixture controls.

Before you do your first flight, and at regular intervals thereafter, get someone to help you check that the throttle and mixture controls do, indeed, move the appropriate range to the full throttle/full rich positions and also to the idle/cut-off positions without the use of any helper springs. If you cannot get the throttle and mixture controls to work satisfactorily without springs, consider going to push/pull

cables. I realize this is a hassle, but not nearly as much of a hassle as losing control of your engine at a critical time.

I installed a push/pull throttle cable when I installed an Ellison throttle body almost 1200 hours ago. (This is a mandatory requirement when you install an Ellison and not a bad idea for any carburetor). I carefully measured to determine the exact length required, then ordered a custom-made aircraft push/pull cable from Aircraft Spruce. I removed the throttle lever from the Brock throttle quadrant and scribed around it onto a piece of 1/16" thick 2024-T3 aluminum, adding about 2-1/2 inches to the bottom of the throttle lever. This was band sawed out and deburred.

A small rodend, screwed and jam-nutted to the push/pull cable end, bolts to this lower end of the new throttle lever. The outer cable is secured to a bracket mounted on the inside of the left arm rest (I used a "u" bolt located in the groove machined in the end of the outer cable).

At the engine end, the outer cable fits perfectly into a bracket mounted on the Ellison throttle body (provided by Ellison) and the cable end has an aircraft-type ball and socket. The "ball" bolts onto the throttle lever and the "socket" screws onto, and is jam-nutted to, the cable end. The "socket" fits onto the "ball" and is held securely in place by a threaded insert that can be tightened onto the ball and is safetied with a cotter pin.

Exactly the same system can be used for the mixture control. There are many acceptable ways to obtain reliable engine controls. Just be certain in your own mind that what you have installed is fully functional and safetied so that it cannot possibly come undone or separate in some way. Have other builders or an A&P look at your work, the more pairs of eyes that check your system, the less likely you are to have a failure and a failure in this area is not acceptable and will almost certainly result in, at least, a forced landing. Never forget that!

WATER IN FUEL

A recent off-field landing in a Long-EZ, fortunately with no injuries, forcibly brought to mind the ritual of checking for water at all the drains. A standard Long-EZ has a gascolator drain on the firewall which should be easily accessible through the cowling inlet. This should be drained before each flight, once the airplane is in the level position (on all three wheels). There is a water drain at the forward end of each main fuel tank and these must be drained before each flight but before the airplane is moved. That is to say, while it is parked in the normal nose down position. Do not lift the plane up to the 3-point

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position until after you have checked these two water drains. If you are in the habit of normally parking your EZ in the level, 3-point position (tying the nose down), you should consider installing low point water drains in each sump blister and then check them religiously before every flight.

Where does the water come from? Sometimes, but rarely, from the gas pump (or gas truck), very rarely, if ever in a composite EZ-type, from condensation in a less than full fuel tank. This is common in metal airplanes. That is why it is normal to top off the tanks in any Spam Can after a flight. Because the fuel tanks in any RAF design are insulated sandwich construction, they are similar to a thermos bottle and condensation does not normally form on the inside of our fuel tanks. The most likely way for water to get into your fuel tanks is a leaking fuel cap on an airplane left out in the rain. The "O" rings on any of the commonly used fuel caps do not last forever. Far from it, in fact. Ozone, ultra violet light and many airborne pollutants attack these rubber "O" rings. Check them frequently and replace them as soon as you see small cracks in the outer edges of these "O" rings.

Be especially diligent about checking your water drains if you have left your airplane out in the rain. Also, if you fly into an airport on one fuel tank with no problems, consider taking off and climbing to a safe altitude on that same, known to be free of water, fuel tank. Switch to the other (unknown) tank only after you have plenty of altitude to allow a safe return to the airport in the event water may be in this fuel tank. This philosophy is an old one but a good one. For the same reason, if anything untoward happens when you switch tanks, always switch back to the first tank before you try anything else.

BROKEN STARTER CASE?
Recently, we heard of a couple of builder/flyers with this problem. It reminded us of the time we broke the starter on the rear engine of the Defiant, in flight, resulting in a single engine return and landing.

Rather than try to reinvent the wheel, I would like to recommend an article in the July 1993 Sport Aviation. It is written by Bob Nuckolls and can be found on page 57. If you are close to deciding on a key locking, rotary mag switch, Bob's article entitled "Magneto switch options" is mandatory reading.

There is definitely a general misunderstanding about wiring magneto switches and a mistake here can be critical to the health and well being of your starter, your engine and, maybe, even your own body! This problem is exacerbated by the use of the modern lightweight starters that are becoming so popular.

BLISTERS IN THE PAINT
Our thanks to Ian Wilde (Long-EZ G-BOOX) from England for all of the carefully researched material on this subject. I guess we are pretty naive about problems like paint blisters living here in the very dry conditions in the Mojave desert. Paint blisters are rare in our neighborhood and just about any paint system seems to hold up quite well.

This is not at all true, however, in more humid areas of the US and, indeed, any other country including England. Ian reports having severe blistering problems over just about all of G-BOOX (except main gear legs and cowling). He had the paint job done by an experienced aircraft painter in an unheated paint booth. Contouring was done with epoxy and micro and lots of elbow grease! Featherfil (a polyester material) was used as a "fine finish" over the micro. Corlar epoxy

primer was sprayed over the Featherfil (allowing plenty of time for the Featherfil to completely dry as Ian was very aware of the hygroscopic nature of polyesters and he is adamant that this care was taken). The Corlar was allowed to cure overnight (per the data sheet) then wet sanded and allowed to dry. The sanding did break through in a few places. They did not spray any Corlar over these areas (a mistake, I believe - ED). DuPont's Imron top coat was then sprayed overall, all of this done in accordance with the appropriate data sheets.

One wing blistered so badly that it had to be refinished within 6 months. The other blistered but it was 4 years before it required refinishing. The canard now needs refinishing after 5 years. WHY? The consensus from DuPont is that moisture was somehow introduced into the paint

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films. Apparently all paint systems have a process called "osmosis" which is the facility to allow moisture to pass back and forth through the paint films and no paint system is tight enough to prevent this process.

The possible sources of moisture suggested by DuPont are: 1) Moisture contamination from the compressed air system. The compressor tank may need to be drained completely and, depending on humidity and weather conditions, should be drained several times a day. Water traps must be used in the air lines. 2) Spray painting when the weather is bad - raining or very humid. 3) Using the wrong thinner. The correct thinner must be used with each and every coat of paint, the primer, the primer filler, the top coat. Do not use one manufacturers thinner with another manufacturers paint, however good either may be. It is even worst to use a cheap quality thinner since these materials often have a moisture content well above specified limits. 4) Flash point and drying times, as called out by the paint manufacturer, should be strictly adhered to. Many paint jobs are rushed, the painter thinking he is saving time but, in the long run, this can cause blistering. Applying a top coat too soon over a primer may not allow full evaporation of the thinner. This entrapped thinner will force its way through the top coat causing micro blistering and it may be months before conditions and temperatures are right for this to happen. GO SLOW, and follow the directions. 5) An even paint film weight must be used. If you sand through a primer, re-spray the primer. Low film weights are one of the most common causes of blistering, especially when combined with adverse environmental conditions as described above. 6) Contamination, such as salts (from finger prints) or from water containing minute quantities of salt, can cause blistering. 7) Applying a solid wax polish to paint when it is still fresh should be avoided. Wax can seal the surface of the paint and trap thinners which can, in turn, lead to soft top coats and possible subsequent blistering. 8) Finally, allowing the painted parts to "cure" in an area where there is high humidity can cause blistering later on because isocyanate activators are, themselves, "moisture seekers" and while not fully cured, can attract moisture.

What did Ian do to try to fix this problem? He used the following procedure: Sanded everything off the wing including the polyester Featherfil. He then applied a coat of wet micro and epoxy which was

sanded to contour and, hopefully, would seal the wing. Corlar epoxy primer was applied, sanded and followed by the Imron top coat. The result: Five years later, no blisters. (Careful attention was paid to all of the suggestions above).

CAUTION
A Swiss Long-EZ builder/flyer reports finding the four bolts that attach the landing brake hinge to the fuselage badly corroded. He had removed the brake to install an electric linear actuator and found these bolts heavily corroded. He has been flying for 5 years and has 350 hours on his Long. A regular inspection of these bolts is recommended and this is especially important if you live near the ocean or in a wet climate.

BRAKES AND MASTER CYLINDERS
EZ's require serious diligence when it comes to brake maintenance because the brakes are not only used to slow or stop the airplane, but they are the only means of steering while taxiing.

Recently, there have been two incidents involving brake failures resulting in loss of control, running off runways, through ditches, causing no injuries but seriously damaging both airplanes. The damage included ripped out landing gears, broken wings/winglets and even a broken canard.

Maintaining the brakes is absolutely essential to the safe operation of an EZ and is easy to forget or ignore because most EZ's have wheel pants fitted that hide the brakes. Make it a habit to routinely and regularly remove these wheel pants and carefully check the brake linings for wear. Look for any sign of hydraulic leaks. These will appear as a dark stain at the threads of a "B" nut or fitting. Do not use shop air to blow the dust out of the wheel, this dust consists of asbestos or asbestos-like particles which could be very harmful to your lungs over the long term. Rather, use a high pressure water jet (a garden hose) to flush most of the dust, then use a commercial brake cleaner in a spray can (available at auto parts store) to completely clean the entire brake

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caliper, brake disc and wheel. Replace worn brake linings and fix any hydraulic leaks. Allow the brake assembly to dry out completely before going flying.

If you have Nylaflow brake lines, you should change them out every year when you do your annual inspection. Nylaflow is easily damaged by ultra violet (sunshine) and is prone to damage from the radiating heat of the sometimes red hot brake disc. To be safe, change them out as often as necessary. I, long ago, went to Stratoflex Teflon/stainless braided brake lines and have never regretted this upgrade.

Brake master cylinders are all too often ignored. Every couple of years, or more often if you have a brake problem, you should remove and dismantle these critical parts. Replace any suspect "O" rings and thoroughly clean all the parts. (Denatured alcohol works well). Use a bright light and examine the bore of each master cylinder. If there is

any scoring or other contamination such as rust, consider honing the bores prior to reassembly.

Aircraft hydraulic brakes are always filled from the bottom of the brake caliper. The hydraulic lines should run continuously uphill to the master cylinder to assure that the fluid drives all of the air out of the system as it is forced into the small brake bleeder on the lowest part of the brake caliper. Have an assistant watch for the fluid as it gets to the brake master cylinder or reservoir. They should do this using a flash light and looking through the small threaded hole usually plugged with a plastic plug.

If you have to do this job alone, you need to make up a clear plastic tube with a fitting on one end that will screw into the 1/8" pipe threaded hole in the reservoir. The plastic line should be long enough to reach out of the reservoir and down to a can on the floor. You must be able to see this plastic line as you pump brake fluid into the brake caliper. (I use a large trigger-operated oil can and it never gets used for anything else!). Continue to pump until you can see brake fluid flowing through the overflow line you have installed. Usually there are a few bubbles in this line. Continue to pump until there are no air bubbles. Now, as you are pumping, tighten the 1/4" nut that is the bleeder. Do not over tighten this nut, it only needs to be firmly snug. Remove the overflow fitting and plastic line and siphon a little fluid out, lowering the fluid level about 1/2" in the reservoir. I use a 3 foot length of Nylaflow to suck the fluid out. Be careful not to get any in your mouth, it tastes awful! Replace the plastic plug, be sure that it has a small breather hole (1/16" dia. is fine) drilled through it.

Careful maintenance is the key to safe flying - and don't forget, the airplane will usually let you know before it bites you. If you notice a change in your brakes, don't fly - fix it first!

NAVAID WING LEVELER TRACKING
Andre Deberdt reports that the fix recommended in the CP for this problem, namely, to reduce friction in the roll control system, worked very well for him. He replaced the phenolic bushings in the wing roots with ball bearings and now his NAVAID tracks to the degree - and besides, his control stick has much lower friction and the Long-EZ is more fun to fly.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

ALL RAF DESIGNS - NO PLANS CHANGES THIS CP.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce	Wicks Aircraft
PO Box 424	410 Pine Street

Fullerton, CA 92632
714-870-7551

Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA
98237
206-853-8947

SHOPPING

FLUSH, INTERNALLY MOUNTED ANTENNAS
A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk.

Contact: Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

CANARD PUSHER DIGEST, 2ND EDITION
Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now it its 2nd Edition. (For a complete description, see CP57). Includes all builder related information from CPs 24-77. The 2nd edition of the Digest has now grown to over 700 pages, and is professionally printed on double sided 8 1/2 x 11" paper from a laser printed master.

Quarterly updates to the Digest are also available. The updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

CP Digest for the Long-EZ (2nd Edition) $75.00

(Overseas orders add $20.00 for airmail)
Annual Update Subscription (4 updates) $25.00
(Overseas orders add $5.00 for airmail)

CANARD PUSHER NEWSLETTERS "ON DISK"
Stet Elliott has also compiled the text of all the Canard Pusher newsletters in electronic format. The set includes all of the Canard Pusher Newsletters, from the very first one published in May of 1974, to the present. The set of CPs is provided in a text only format which should be 100% compatible with any computer word processor you presently use. It is available for either the IBM or Macintosh platforms. A hard disk is strongly recommended since the set contains over five megabytes of textual information!

This product is ideal for anyone interested in reading about the evolutionary development of RAF's canard designs through the years, or for those builders still plagued with the "I know I read it here somewhere!!" syndrome. With one of the inexpensive text search and retrieval programs, text string searches across the entire set of files are a snap.

CPs on disk costs $65.00. Specify disk size, (3 1/2" or 5 1/4"), platform (IBM or Mac), and disk capacity.

For either the CP Digest for the Long-EZ, or the CPs on disk, contact:
Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-8233

VARIEZE INDEX
Lists all plans changes from CP10 through CP68 as well as all suggestions, problems, etc. For any VariEze builder, this is a must. Bill sells it a couple of different ways. You can buy just the

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printed book for $20.00 or you can get the book plus a 5-1/4" IBM compatible floppy disc with a delimited ASCII listing of the data base (or optional PFS professional file data file) for $24.00. Specify which you would want. This index will be updated annually.
Contact: Bill Greer
811 Cooper Square Cir. #240
Arlington, TX 76013
PLEASE NOTE: Those of you who have the first edition, Bill has improved the indexing of several topics and added more cross-indexing You may find it helpful to get an up-grade.

DEFIANT FLYER
If you are building a Defiant and you are not currently receiving John Steichen's Defiant Flyer, you are missing a bet. This publication is exactly what is required by both builders and flyers. It contains all kinds of helpful information and great articles. Bayard DuPont's letter on his Ford-powered Defiant in the December issue is a case in

point. See CP67, page 2 for information on subscribing to the Defiant Flyer.

Seen at Oshkosh. Beautiful leather seat cushions (also available in various fabrics) for Long-EZ, VariEze and Defiant.

Contact: Diana Davidson
Alexander Aeroplane Co.
900 S. Pine Hill Road
PO Box 909
Griffin, GA 30224
404-228-3901

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
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Pre-cut wing & winglets	1199.00
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Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00
Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE
We now have available VHS tapes of two of Burt's talks at Oshkosh '93.

Tape #1 - Design College - Cockpit of the Future.
Tape #2 - RAF Builder's Support Forum.

Please send $20.00 per tape to RAF at 1654 Flight Line, Mojave, CA 93501. We will pay the postage.

Charms-Long-EZ/VariEze (gold or silver) 6.50

Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	25.00
Go-A-Long-EZ	25.00

FOR SALE
F-16 DEEP STALL INCIDENT VIDEO
Gives a pilot's-eye view of a deep stall which almost doesn't recover. Includes a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall, as well as a transcript of the audio portion (for clarity).
Price - $13.00.

Contact: Charlie Precourt
7015 Little Redwood Dr.
Pasadena, TX 77505-4433

AIRCRAFT COVERS
Custom cover for your Long-EZ. This neat design completely covers your prop, canopy and nose and only uses two straps. Made from space-age Evolution 3 material. Reasonable price.
Contact: Tony Brazier
PO Box 6478
Ocala, FL 32678
904-237-1811

NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it. Contact:
Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze.
$35.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

ORIGINAL REM 37 BY SPARK PLUGS. These are the short ones available up to mid 80's. New - $17.00 ea.

They were the "thermos" expanding "o" ring-type. This type of fuel cap requires regular lubrication of the ''O' rings at 25 hour intervals. If this is not done . . . . .
Contact: Steve Franseen
303-987-2985 (leave message)

FOUR STACK STAINLESS EXHAUSTS
Further update on the all stainless steel 4-stack exhaust pipes. They are now available with springs and slip tubes at the flange or with ball joints, builder's choice, each still has the original slip tube support on each side to keep the pipes totally independent of each other. They have 1/4" type 321 stainless steel flanges and type 321 .035" stainless steel tubes. The tubes are "degreased" inside and out before they are purged or back-gassed with argon while being welded (others don't do these two very important steps). They fit Lyc. engines for any pusher aircraft, EZ's and Cozys, etc. - Cost - $500.00 plus $15.00 shipping and handling.

Also, if anyone would like to have ball joints fit and welded on their existing pipes, the cost is $150.00.

The RAM AIRBOX is still available at $325.00. Reusable foam air filter - $20.00 plus $11.95 shipping and handling.

The increase of performance of both 4-stack exhaust pipes and airbox combination is very impressive, about 200 rpm on the average Long-EZ installation. Builders can call or send SASE for a flyer. Both items come with an installation sheet.
Contact: Hal Hunt
6249 Longridge Ave.
Van Nuys, CA 91401-2528
818-989-5534

HARD TO FIND BELLCRANK BEARINGS
Bellcrank bearings for control systems are now in stock again. Due to a nation wide shortage, Wicks has contracted with a local manufacturer to provide as many as needed. They just received 5000 of the BC4W10 bellcrank bearings which are used on many experimental aircraft.

THE LATEST IN LAMINATING EPOXY
In stock - a large supply of the newest laminating epoxy available. PTM&W Industries 2032 Epoxy Resin and 3660 Hardener is designed for all types of structural applications and for all your laminating needs.

PTM&W Industries, working with respected aircraft designers, has developed this new epoxy laminating system to be the safest to use, and to

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have the best chemical adhesion on fiberglass, carbon fiber, Kevlar, etc.
Contact: Wicks Aircraft Supply Co
Bill Weder
618-654-7447 or
1-800-221-9425 for a free
catalog.

PARTING OUT A LONG-EZ
Lyc. 0-235 2400 TT, 46.6 hours since major. Landing gear with wheels and brakes, nose gear, stereo headsets with intercom and much more. Send SASE for complete list:
Contact: Barbara Raymond
Box 214
Big Oak Flat, CA 95305-0214
209-962-5752

NOSE WHEEL SHIMMY DAMPER
Bob Davenport tells us that he can still supply this excellent damper. Unfortunately he gets very few orders nowadays but can sell them even if he gets only one order. Including the set up charge, the cost is $236.00 delivered in the USA.
Contact: Bob Davenport
PO Box 650581
Vero Beach FL 32965-0581
407-567-1844

AILERON/RUDDER HINGE RETROFIT KIT
The purpose of this kit is to effectively prevent additional wear on the aircraft hinges and thereby circumnavigating a time consuming hinge repair down the road. The hinge kit will fit any MS20001-P3, '-P4, '-P5, or '-P6 extruded aluminum piano hinge that is specified for use on the Long-EZ, VariEze, Defiant, Cozy, Glasair ailerons and/or rudders. You will be supplied with enough Teflon spaghetti tubing and a special high grade stainless spring steel wire for all the hinges used in the ailerons and rudders.

This hinge kit will work in an already worn hinge, but just how worn out (larger I.D. of hinge hole) remains a question we cannot answer. We believe the DuPont/Teflon tubing supplied in the kit will wear proportionally to the amount of space between the tube and the hinge. After more than four years there has not been any additional wear on any of the installed retrofit kits that we know of.

INSTALLATION: I enclose detailed instructions with each kit explaining several different installation methods used by various builders.

Pleas note: These kits cost $27.00 US within the USA and Canada. Overseas, the cost is $31.00 US. All orders shipped in the 48 continental United States will be UPS, the rest are shipped by mail. Please add $2.00 US on Rutan Defiant Kits and $10.00 on Solitaire kits. Please try to send the correct amount as kits will be sent COD (balance owed) unless other arrangements are approved by us.

When ordering any of the kits, please supply the following information for purpose of giving you the proper kit supplies and providing emergency updates should that necessity arise. Shipping costs are included in the above prices.

1. Name and address. Kits cannot be delivered by UPS to a PO box. Address must be a physical structure. Please type or print clearly.
2. The serial number the kit designer has given you and your government supplied tail number, if you have them.
3. Phone numbers for both work and home, if that is as all possible or practical.
4. Type of aircraft, e.g., Glasair, Defiant, Long-EZ, etc.

Contact: Gary A. Hall
851 SW 63rd. Ave.
North Lauderdale, FL 33068
305-971-9731 (home recorder)
305-477-0809 (SoftSol Corp.)

WANTED

VariEze prop - new or used, for Cont. 0-200.
Contact: Cindy
303-440-3579

One set of 500x5 wheels and brakes, complete.
Contact: Byrdell Mathews
26311 Hwy 75
Spring, TX 77380
713-523-1751

PHOTOGRAPH OMITTED. PHOTO CAPTION GIVEN BELOW
"Quiver", a high-altitude, unmanned air vehicle - seen here on its second flight with Doug Shane in the saddle. Several flights were flown manned to prove the systems before flying as an RPV.

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Back issues	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 79.
VariViggen (2nd Edition), newsletters 18 to 79.
VariEze (1st Edition), newsletters 10 thru 79.
VariEze (2nd Edition), newsletters 16 thru 79.
Long-EZ, newsletters 24 through 79.
Solitaire, newsletters 37 through 79.
Defiant, newsletters 41 through 79.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: RUTAN AIRCRAFT IS OPEN TUESDAY ONLY FROM 8:00 TO 4:00. When you call on Tuesdays, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

325 MILES NORTH OF THE ARCTIC CIRCLE.
Dick Rutan called me from London, Ontario where he was giving a talk and asked if I would be interested in flying up to Point Barrow, Alaska - Wow! Barrow is almost 72 degrees North Latitude and more than 325 miles north of the Arctic circle. Sally did not want to go nor did Chris, Dick's fiancee. So, what the heck, I arranged to meet Dick the next day on the Friday Harbor airport. Sounded like a great boondoggle to me!

I departed Mojave the next morning and flew direct toward Friday Harbor, an island northwest of Seattle, WA. Primary navigation was GPS. My panel-mounted King KLN 90 GPS was backed up by a Flitemate Pro GPS driving Mentor Plus' Flite Star and Flite Map which ran on my 270C MacPowerbook. (The belt and suspenders approach!). The GPS antenna was velcroed to the top of the headrest - worked great!

Unless you have flown with a color moving map that gives you almost unbelievably accurate knowledge of your position, you really can not appreciate how neat this is. This trip proved this system out to me as the navigation system of the future. This, or something very close to this, is what we will all be flying with in the future.

The weather was great from Mojave to Portland, OR but went bad north of Portland. The clouds went from the ground to 17000 feet, so I landed at Ellensburg, WA. To my amazement, when I taxied up to the gas pump, Dick was parked there topping off his fuel tanks! He had tried to get to Friday Harbor just as I had and had landed to check the weather and try to figure out how to join up with me. Just when I was wondering how in the world I could contact him!

We checked the weather and filed an ADCUS flight plan to Nanaimo, Canada where Dick has some friends and where the weather was excellent. We overflew the weather and landed at Nanaimo where we cleared customs. We then flew on to Qualicum, Vancouver Island. We spent a beautiful day fishing for salmon and enjoying the hospitality of Dick's friends, Bob and Cherry Ekoos. They have a beautiful home on the coast of Vancouver Island.

The next morning, we departed for Campbell's River, the nearest place where we could file a flight plan (all flights, VFR and IFR, must have a flight plan filed in Canada). We filed to Juneau, Alaska and flew up the coast in light rain and low ceilings. The coastline is very rugged, lots of islands with rocky coastlines and millions of trees. There were no roads at all and airports are few and far between. There is no VFR-on-top in Canada so we were forced to remain under the solid overcast until we reached Ketchican, AK where we climbed to on-top and flew on to Juneau.

We overflew the Mindenhall glacier in the foothills just behind the city of Juneau, then landed at Juneau airport and cleared customs. This cost $25.00 a piece for each Long-EZ - the US customs was much more of a hassle than the Canadian customs. We had lunch and checked the weather. It was good all the way to Barrow! We filed to Fairbanks and flew up the coast from Juneau to Skagway, then inland over Canada to Whitehorse, then roughly along the Alcan highway to Northway, Alaska, then on to Fairbanks. It was 87 degrees F at Fairbanks and the weather was perfect, however, it was below minimums at Barrow so we spent the night at a beautiful hotel near Fairbanks airport.

The next morning, 4th of July, 1994, we filed to Barrow where the weather was 400' overcast and 6 miles visibility. We ran into rain and low ceilings in the Brookes Range and poked our noses into several passes before finding one that was marginally VFR. We flew through the Anaktuvuk Pass and over a small Eskimo village of the same name where there was a short, gravel runway - not much good for us!

The weather improved a little north of the Brookes Range and we flew toward Barrow over country that was flat and covered with thousands of lakes. There are no trees and no roads, only tundra. This was the North Slope. Gradually, a scattered undercast became solid and, by the

time we reached Barrow, we were between layers at 3000 feet. We shot an approach at Barrow and broke out on the centerline of the runway at 400 feet. The GPS-driven moving map depicted this graphically and was very comforting!

The North Slope Search and Rescue took us under their wing and found us a hotel room and provided us with huge parkas (it was 33 degrees F). Price Brower, a Barrow native and the Chief Pilot for Search and Rescue, treated us like royalty. He flew us to every single point of interest in a Jet Ranger helicopter and later invited us to his home where we had the dubious experience of eating maktak (the skin and blubber of a bowhead whale which had been captured by Price's village). We watched the Eskimo Olympic games which were being held in Barrow and went on around the clock since it did not get dark all night.

At almost 72 degrees north latitude, the ocean was frozen as far as we could see. All of the buildings in Barrow are built on pilings and are 6 feet above the permafrost. The high on July 4th was 33 degrees F! The sun does not set at this time of the year, it simply circles around the sky about 30 degrees above the horizon!

The next morning, we headed down the coast of Alaska toward Prudhoe Bay. We flew very low and followed the coastline looking for polar bear and caribou. We saw hundreds of caribou but no bears. We did fly by two DEW line (early warning radar sites) that are no longer needed but were still manned with skeleton crews. A more remote place you will never see! We flew a low approach to Prudhoe Bay airport (Deadhorse), then turned and followed the gravel service road that parallels the oil pipeline.

We essentially followed the pipeline almost all the way to Fairbanks. We crossed the Brookes Range via the Atigan Pass and were fortunate to clear the highest point in the pass, 6500', due to rain and low ceilings. We decided to bypass Fairbanks and flew directly towards Anchorage. The weather really deteriorated and we flew through the broad pass from Nenana through Talkeetna to Anchorage with driving rain and less than 1 mile visibility. This was our longest leg, from Barrow to Anchorage, just over 6 hours, much of it flown in heavy rain. We landed at Merrill Field in downtown Anchorage where we were met by Fred Keller and his wife, Judy.

We stayed with Fred and Judy for two nights and Fred very kindly repaired my rain-damaged prop (Dick's is a B&T with the urethane leading edge and was essentially undamaged). They lent us a

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car and we visited the local points of interest. It was a neat time and we needed the rest.

We departed from Anchorage and flew south over the Portage Glacier to Valdez, then on down the coast which was much friendlier here with beautiful beaches and quite a few airports. We landed at Yakutat for lunch of fresh caught halibut. This is the place for fishermen. They catch several varieties of salmon and it is fairly routine to catch 400 lb. halibut here!

After lunch, we flew on down the coast and then inland to Glacier Bay. What a spectacular sight! We continued over Gustavus where the Glacier Bay Lodge is, on down the central islands to Sitka, AK. We spent two days at Sitka which is really a beautiful place and the site of the original Russian capital of Alaska. We saw all the historical sites (Dick is a fanatic about such things!), met some really fine people, and I can tell you this: I intend to return to Sitka, sometime, with Sally.

We departed Sitka on a rainy, cloudy day and flew low along the coast all the way to Arlington, WA where Dick landed to give a couple of talks at the Arlington Fly-in. I continued on to Madras, Oregon where I filled the tanks with 100 low lead and headed south across Nevada and down the Owens Valley to Mojave. 10.2 hours of flying with one stop - Sitka, AK to Mojave, CA - 1514nm, 1741sm.

We had flown more than 6000 miles in 8 days. I used 281 gallons of fuel and N26MS performed perfectly for almost 40 hours. We both made it to the most northern point in the USA where the Eskimos showed us great hospitality. A marvelous trip in the company of a good friend. All take-offs and landings were flown in close formation, as was the approach into Barrow. We flew more than the distance from Mojave, CA to London, England in only 8 days and this trip brought back, once again, what magical flying carpets the Long-EZs are! For a trip like this, GPS is not a luxury and should be considered mandatory. The moving map was fabulous and it was very reassuring to always know exactly were we were.

Plan long trips, and go for it!

PROP EXTENSION FAILURE
At Oshkosh this year, we were shown photographs of a prop extension that had failed, catastrophically, resulting in the loss of the prop and a forced landing that seriously damaged the E-Racer which, while not an RAF design, is a similar pusher. The pilot and passenger were not hurt.

The engine was a Lycoming 0-360, 180hp. The prop was a B&T prop and it was driven by a Brock prop extension 6" long with a 7" diameter flange at the prop end. The fracture started right in the radius between the barrel and the aft flange and propagated across the extension. This fracture has been characterized by experts as being a high cycle, fatigue failure. The total time on this prop extension (and on the aircraft) was 72 hours. What caused this failure? Is it something we should be worried about?

A little history may be helpful here. Several years ago, a good friend who was an excellent engineer and VariEze builder, Bob Beard, experienced a large vibration while in flight, shut it down and glided to a safe landing. He discovered that his 8" long prop extension had an enormous crack in it. (See photo). **PHOTOGRAPH OMITTED** He analyzed the prop extension and found that it was machined from 6061-T6 aluminum instead of the required 2024-T351 aluminum. This happened on his original design aircraft, the Two-EZ, a large four-place similar to a Long-EZ. He had a Lycoming 0-360, 180hp engine and a wood prop.

About the same time, Danny Meyer was flight testing his Velocity, also a pusher, when he had almost exactly the same experience Bob Beard had. It turned out that both prop extensions had come from the same source. Both were made from 6061-T6, both were 8" long and both were using Lycoming 0-360s.

The difference in strength between 6061-T6 and 2024-T351 is only 18-20% so although the wrong material may have been the cause of this problem, at least on an 8" long prop extension, 18-20% is not much margin of safety.

Bob Beard designed a prop extension that had a 4.5" diameter in the middle as compared to a 3.25" diameter on his previous extension. He

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sent this editor a letter and a drawing of his new design and said that this 8" long extension would be just as stiff as a standard Brock 4" long extension and that its natural frequency should occur above 4000 rpm.

We purchased a billet of aluminum (2024-T351) and machined a 9" long modified Beard design which has a 5" diameter in the middle and which has been tested, in flight, to show that peak stress occurs at an rpm that is out of the normal operating range of the engine. The problem with this design is that it does not lend itself to economic manufacture.

We have borrowed a torsional order analyzer. This is a magic box that has a built-in x-y plotter and receives a signal from a magnetic pickup which is mounted close to the teeth on the starter ring gear. Basically, this machine measures the speed of each tooth passing by the magnetic sensor. As the engine drives the prop, it speeds up and slows down with each firing stroke and each compression stroke, this causes the crankshaft, prop extension and prop assembly to twist like a spring. This "spring" winds up and unwinds many times per second as the engine drives the prop. Now, obviously, the magnitude of this windup/unwind action is very small. In fact, this machine measures the rotational displacement in milidegrees, that is to say, thousandths of degrees. One of the uses of this machine is to determine if an engine/prop combination should have a "yellow arc" on the tach. A Grumman Tiger, for example, has a "yellow arc" from 1500 - 1800rpm. This means that the pilot should not operate within this yellow arc. He may pass through it in either direction but must not fly within the yellow arc.

We are concerned that there may be a yellow arc on some of our RAF designs and we have spent many hours flying several airplanes and a bunch of different engine/prop extension combinations. We have talked to experts in this field and the consensus is that a light weight, low inertia, wood prop simply cannot damage a Lycoming aircraft engine - good news! Introduce a prop extension, particularly an aluminum, spool-type, prop extension, and maybe you can have a problem! It turns out that a spool-type, aluminum extension is relatively soft, torsionally. It also turns out that a crankshaft, prop extension, prop assembly is what is called a first mode shape. This means there is

only one node (a node is a point where there is no action or movement - if you grab a spring with one hand at each end of the spring and twist it, someplace in the spring, there is no movement - this is the node). It further turns out that the node in this assembly usually occurs between the crankshaft flange and the propeller. That is to say, most, if not all, of the twisting we are measuring takes place within the prop extension.

With all of the above in mind, we set out to run in-flight tests on Long-EZs with Lycoming engines, 6" long prop extensions and wood props. An 0-235 powered Long-EZ categorically does not have any measurable problem with a 6" aluminum spool-type prop extension. The same is true of a pusher, such as a Defiant, with an 0-320 and a 6" prop extension. It may not, however, be true that an 0-360 with a 6" aluminum spool-type extension on a pusher is as free of problems. (A Long-EZ with any engine larger than a Lycoming 0-235 is not approved by RAF).

We have not fully analyzed all of the data and we plan on generating a finite element model to help with this analysis. At this time, we are unable to say (as we can with the 0-235 and the 0-320) that a Lycoming 0-360 with a 6" or longer prop extension on a pusher-type aircraft is completely safe. Some facts: If you are in the market to buy a Lycoming 0-360 (for your new Defiant), we strongly advise that you purchase one that is equipped with a 6th order damped crankshaft.

We have designed, and are testing, a couple of prop extensions that show promise to eliminate this problem, however, there has been only one failure of a Brock prop extension with many hundreds out there in the field accumulating hundreds and, in some cases, thousands of hours. We will continue to test and evaluate and keep the builders and flyers informed.

The prop extension that did fail had three strikes against it. First of all, the radius between the flange and the barrel of the spool-type prop extension was too small. Other prop extensions we have examined, including several other Brock extensions, have 1/4" radii. The failed extension had only a 3/32" radius (less than half the normal radius). Also, in this radius, there were

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machine marks, tool "chatter" marks, in fact. Expert opinion says that chatter marks in a highly stressed part are bad news. These chatter tool marks are longitudinal "ridges" and are torsional stress risers. Also, the forward face of the prop flange was in the same plane as a change of inside diameter and this area had a sharp radius.

None of these features are good news - all of them in one prop extension are probably bad news. Add to that the possibility of a slightly out of balance prop and then throw in the possibility that the engine/prop extension/prop may have been running in resonance causing maximum stress in the aluminum prop extension.

The torsional order analyzer shows the rpm at which peak stress occurs, if there is such a point. We tested a long-service Brock 6" long prop extension on a Lycoming 0-360-A4A, 180hp engine (with no 6th order

dampers) and measured a peak torsional displacement (windup) of 20 milidegrees at 2770rpm, yet at 2500rpm, the peak displacement was only 3 milidegrees. Running continuously at 2770rpm in this pusher aircraft would probably fail this prop extension. This same test was done using all the same parts, but with a Lycoming 0-360 with 6th order dampers installed, and the peak displacement was only 3-1/2 milidegrees!

With our modified Beard prop extension, these numbers changed significantly even with no 6th order dampers. Peak displacement is only 12.5 milidegrees at 2870rpm! (At 2770rpm, maximum displacement is only 6 milidegrees). This data is all the more impressive when you consider that this prop extension is 50% longer than the 6" Brock extension.

We have designed, and are having made, a 6" long prop extension that we believe will eliminate any problem associated with the 0-360 Lycoming. It has not been tested yet and is not available at this time. We will report on its performance in the next CP.

We would like to state that a correctly designed prop extension should run virtually indefinitely because peak stress would be below the maximum allowable stress. This is the key to the whole problem - the maximum allowable continuous stress must not be exceeded.

We have had the cooperation, not only of Ken Brock Mfg. in this endeavor, but also of Woofter Manufacturing (formally Woofter Custom Metal Fabrication) of Pembroke Pines, FL. We would like to thank Judith Saber of Woofter Mfg. for all of her help. She has machined and sent to us for testing five different prop extensions and she is currently machining a proprietary design which we hope to test soon. If you have not seen a Woofter prop extension, you are in for a treat! Judith runs the CNC lathe and machines all of the various prop extensions sold by Woofter Mfg.- and all of them correct the problems mentioned in this article. The radii are at least 1/4", there are absolutely no machine marks of any kind, and the I.D. has a really clever "S" curve transition from the smallest diameter to the diameter that fits your crankshaft. The workmanship is absolutely first-class and we are very happy to report that just as we were going to press with this CP, Ken Brock Mfg. has decided to order prop extension from Woofter Manufacturing. Stay tuned!

WOOD PROP FAILURES Reprinted from: CLEAR PROP, the newsletter of EAA Chapter 49, Lancaster, CA.
Recent calls from Texas informed us of two Warnke wood props, installed on 180hp RVs, which cracked in flight. There was no perceptible vibration and the damage was not realized until the airplane was back on the ground. Both props were "high aspect ratio" models. Both cracked chord-wise, across the laminations, about 12" from the spinner, right where the urethane leading edge protection is routed into the wood. One prop had been in service 70 hours, the other 130.

Just as we were going to press, we learned of another failure involving a Warnke propeller. We contacted Mr. Warnke and, after some research, he found that this prop was a prototype and no others of the type were in service. (In this case, the blade failed completely on a 160hp RV-4 after 40 minutes of service and no operation above 2400 rpm. About 2/3's of the blade broke off and struck the right elevator, damaging it

severely. The lower cowl was also badly damaged as the unbalanced engine thrashed around, but

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the pilot, in an excellent piece of flying, was able to maintain control and glide to a safe landing at an airport.

We don't know and can't speculate why these failures occurred, but since there seems to be a pattern forming, we felt that all users of the Warnke "narrow blade" prop should be aware that they have happened. We talked with Mr. Warnke and he assured us that he will be doing everything possible to find the cause. Meanwhile, he suggests extra care on both pre- and post- flight inspections. He also noted that, for other reasons, the "high aspect ratio" prop is no longer in production. There are hundreds of these props in use, some with over 500 hours.

DOT 5 SILICONE BRAKE FLUID

We recently received our second letter regarding a problem with the silicone brake fluid, this time in a Defiant. John Rippengal, who built and flies his Defiant in Cyprus, found that after 4 years of use, he had a leak at the caliper on one brake. He dismantled the calipers and found that the 'O' rings were sticky and showed signs of roughness.

Some time ago, we received a letter from a Long-EZ builder with similar complaints. At that time, we recommended a complete tear down of the brake system, including master cylinders, and a complete and careful cleaning of all parts before installing new 'O' rings and new DOT 5 brake fluid.

DOT 5 brake fluid is 100% silicone. Silicone is an inert material and should not react with any other material, however, maybe, when mixed with red aircraft brake fluid, it does slowly attack the 'O' rings.

In spite of these problems, we still believe that DOT 5 silicone is safer because it is not flammable. Normal aircraft brake fluid is highly flammable. There have been several brake fluid fires reported in Ezs and one in a Defiant. So far, we don't know of anyone having lost his or her airplane, but it has been close a couple of times. Since silicone can not burn, we feel that even if it requires a complete cleaning and 'O' ring replacement every 3 or 4 years, it is worth it. Mike Melvill has been using DOT 5 silicone brake fluid for almost 10 years. About four years ago, he did a complete tear down and replaced all 'O' rings, including master cylinders. At that time, he did notice what appeared to be rust in the master cylinders. It was very thin and cleaned up easily using 3M Scotch Bright. He has had no brake problems before or since. We know of several antique-ers who fly J-3 Cubs, etc. who have used only DOT 5 silicone for more than 15 years with no problems.

If anyone experiences a problem with silicone brake fluid, please let us know so that we can share it with others. Also, if anyone out there knows of a different 'O' ring material that perhaps should be used, please drop us a line.

COOLING PROBLEMS (SOLUTIONS?)
Oil and cylinder head cooling are probably the single largest source of letters to this editor. Several builders have resorted to installing two oil coolers in series which we are told definitely fixed the problem.

Mike obtained a much larger than normal oil cooler about 4 years ago and has been running it ever since. It is a Stewart Warner, part #10634R. It has 13 segments and is almost square in the top view. It is the same thickness as the standard 7 segment oil coolers. Contact Stewart Warner, Southwind Division, in Indianapolis, IN for your nearest dealer. This is an expensive oil cooler but it absolutely has cured the problem. It is mounted on the bottom cowling as called out in the plans.

Mike recently increased the radius of the lip of his NACA cooling inlet from about 1/4" radius to a 1/2" radius which actually reduced the size of the inlet but it dramatically improved the cylinder head cooling. A sharp radius on the intake is a no-no.

LONG-EZ FUEL TANK VENTS AND CAPS
A little history is needed here. The plans show only one vent in each fuel tank. Mike and Sally built N26MS according to the plans and soon discovered that one vent in such a large, flat tank is not enough! When parked out in the sun, nose down, the air above the fuel is heated by the sun and expands, forcing the fuel up and out of the vents. This fuel then spills into the cockpits! I

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am sure more than a few of you have experienced this problem!

The answer was published in CP27, page 9 and consists of a second vent line that is located in the inboard, aft corner at the top of each fuel tank. There should be four 1/4" aluminum fuel tank vents protruding out of the top of your fuselage just forward of the cowling. Do not run all or some of these separate vents together. For redundancy, they must be separate. This will fix the leaking-vent-in-the-hot-sun syndrome.

At the time, Mike was ready to do his first flight so he solved the problem by drilling a small hole in the fuel caps. While this fixed the leaking vent, it ruined a pair of very expensive fuel caps and, also, made it impossible to park nose down with full fuel tanks. It also made it possible for rain to leak into the fuel tanks resulting in small quantities of water in the fuel tanks after the airplane had been parked outside in the rain.

Recently, this problem was solved by installing the second vents in each tank and by removing the drilled fuel caps and installing Newton Aero fuel caps. These are sold by Aircraft Spruce and are made in England by Robin Voice. These are truly works of art! They have been in production for more than 10 years and can be found on a wide range of Ducati motorcycles as well as such supercars as the Ferrari F40 and the Jaguar XJ220. It is also common on many European racing cars and motorcycles.

It is a solid aluminum cap in an aluminum ring that is bolted into the tank with a ring of stainless allen bolts. The cap and receptacle are anodized and buffed to a bright finish and they look really fine mounted flush with the skin. The recessed tab is pulled up and rotated 90 degrees. The cap is then lifted out. Mike added a safety chain which is mandatory and he is absolutely delighted with these completely fuel-tight fuel caps. Take a look at them next time you see Mike and Sally at a fly-in.

These caps sell for about $85.00 each and can be found in the Aircraft Spruce catalog under "fuel caps" They are the Newton Fuel Caps. They are also available with key locks installed to prevent losing fuel to thieves. (See photo). **PHOTOGRAPH OMITTED**

LETTERS
"RAF,
During a recent annual inspection, I found the rubber valve portions of my ACS carb heat box to be deteriorated to the point of separation. As you can see by the enclosed sample, it is obvious that a portion of the rubber is about to separate and could have been ingested into the engine causing a possible engine failure.

I purchased the carb heat box for my 0-235-L2C-powered Long-EZ from ASC in 1986 and my first flight was June of 1991. I had logged 450 hours on the airframe when the problem was discovered. I have since replaced the torn rubber with red silicone baffle material and it works fine.

I am writing you about this dangerous and potentially fatal situation so that you might follow-up and inform other ASC customers who may have bought this unit about the obvious flaw.
Sincerely,
Frank Nowak"

ACCIDENTS AND INCIDENTS
A VariEze got away from its owner recently while hand propping. A friend, a non-pilot, was asked to monitor the throttle while the owner propped it. It started, unfortunately the throttle was full forward, and the non-pilot did not retard it but did hang on for the ride of his life as it scooted across the ramp on its nose. It finally struck a steel fence post which cut a 3" wide slice from just left of the pitot tube in the nose, all the way aft to the shearweb/spar cap of the canard! An expensive lesson. Fortunately, no one was hurt but the damage was extensive.

Always have a pilot who understands the EZ throttle and mag switches monitor your controls while you prop it - or better yet, get a B&C light weight starter!

Charlie Mottier sent this letter to RAF regarding his ditching in the ocean off the Berry Islands in the Bahamas. Unfortunately, the airplane was a total loss but the good news is that Charlie and his wife, Phyl, survived with only minor cuts and

bruises. His letter is printed in its entirety in the hope that this information may help someone someday.

"Following Sun-N-Fun '94, nineteen canard-type aircraft flew to Great Harbor Cay in the Berry Islands (67nm south of Freeport, Grand Bahamas) for some well deserved R&R.

On the flight home our Long-EZ experienced a loss in engine power about 15 minutes into the flight and we subsequently ditched the plane in Big Sturrup Bay off the Berry Islands.

When the problem developed, we immediately advised our flying partner and then changed frequency to call in a Mayday which was acknowledged by Customs at the airport. We advised that we were attempting to return to the airstrip and requested landing priority. On that frequency, all inbound and departing aircraft were advised of the emergency.

When it became apparent that we would not make the field, the decision was made to ditch rather than to put the plane in the trees on the adjacent island as I felt there would be less chance of fire in a water landing. Our landing speed into the wind and with calm seas was about as low as possible to keep the sink rate to a minimum. The main gear hit first and pitched the plane forward. The canard was sliced off cleanly at the fuselage on both sides. The plane dove under water and the canopy was lifted right out of its frame. We came to rest dead in the water and perfectly level. With the canopy gone, I simply stood up and turned to check up on my wife who was in the back seat. Boats to help arrived within 3 minutes and, after sending Phyl to the local dispensary, we towed the plane to the shore.

I suffered no injuries other than some minor cuts and bruises and required no medical attention. Phyl suffered some sore ribs on her left side and some minor cuts, but on complete examination in Ft. Lauderdale, was pronounced fit and was released from Browder Memorial hospital.

There are at least two important points for EZ drivers from this experience: 1) A water landing is survivable although it is hard on the plane. My plane floated, it was heavily loaded and it floated entirely level. We walked on the wings as did others and it was very stable. In attempting to stretch the glide to reach the airport, the nose gear was not extended. If I had to do it over again, I would put the nose gear down. That might help soften the forward pitch when the main gear digs into the water. (Also, the landing brake should be deployed - ED.). 2) Most of our problems have developed from dealing with our own FAA. They advised immediately and strongly that we were in violation of the law by being in Bahamas air space without receiving prior written approval from the Bahamas government. That restriction is shown on the back of your pink Experimental Airworthiness Certificate. It is item D and among other things, restricts experimental aircraft from flying over any foreign country without the special permission of that country. That means "in writing and in advance".

In summary, we do not know what happened to our factory-new, 250-hour, Lycoming 0-320, 150hp engine. The plane took all of the licks and we

elected to total it. The passengers suffered almost not at all. Not a pretty story but we think one with a happy ending.

We want to thank our Canard friends who agonized with us as we splashed down and for their continued support through phone calls and cards.

Charlie and Phyl Mottier"

STATIC FUEL FLOW CHARACTERISTICS
We often receive inquiries as to what the acceptable static fuel flow is on an EZ or Defiant. While draining all of the fuel prior to installing new fuel caps into his Long-EZ recently, Mike took the opportunity to carefully measure the fuel flow. Here are the results: The fuel line was removed at the carburetor and run into a container. The fuel was allowed to flow for 6 minutes, exactly, then the container was weighed and the fuel flow was calculated. This was done with the in-line boost pump off, and with the boost pump on.

With 12 gallons in one of the tanks, the free flow with the in-line boost pump turned off, was 7.1gph. With the pump turned on, this increased to 21.1gph. With only 2 gallons of fuel in a fuel

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tank, the free flow, boost pump off, was 5.3gph, with the boost pump on, it increased to 19.8gph.

This airplane has a Lycoming 0-360 engine and the fuel supply to this engine has been very adequate over the past 1400 hours without the boost pump running, and at altitudes from sea level to 27000 feet. If your fuel flows are at least this good, you have nothing to worry about.

This test should be carried out by anyone who is preparing to fly a new airplane. Check the flow with 10 to 12 gallons in either fuel tank, boost pump on and off. Then repeat the test with a minimum fuel, such as 2 to 3 gallons. If you do not have flows similar to the above, you probably have a blockage in the fuel lines somewhere and this should be corrected before you attempt your first flight.

Mike ballasted the airplane so it was level on all 3 gear (not parked nose down). His fuel valve is between the pilot's legs, exactly per the plans. His boost pump is in line (all the fuel must go through the Facet fuel pump) per the plans. The only addition is the presence of a flow-scan fuel flow transducer between the engine-driven, mechanical fuel pump and the carburetor. This transducer was left in place for this test.

WHAT CAN I DO TO COMBAT THE HAZARDS OF 100LL FUEL IN MY 80 OCTANE CONTINENTAL 0-200 OR LYCOMING 0-235?
We have been asked this question a number of times and, over the years, we have accumulated a few answers for those whose engines simply were not designed to live on low lead fuel.

Use TCP as recommended on the can. Pure TCP can possibly harm glass/epoxy fuel tanks but we used TCP on the RAF Long-EZ prototype, N79RA, all of its life with no measurable problems and the TCP will definitely help your engine digest the modern low lead fuel.

Lean your mixture, even while taxiing. Richen it for take-off and then lean in flight using a good quality EGT gauge. A good rule of thumb is that you can lean aggressively above 8000 feet (below 75% power) or if you have a manifold pressure gauge, when you are below 22"MAP.

The bad news is that, in spite of these precautions, you should expect to have to remove your valves and ream the carbon build-up out of the guides every 300 to 400 hours. If you don't, you will experience sticking valves. If you can get 80 octane avgas, by all means, use it. Your engine was designed to run on leaded fuel and that is why you may be having these problems.

LIGHTNING STRIKE!
Long-EZ builder/flyer, Dan Worley, sent in a couple of photos and a report of a lightning strike. **PHOTOGRAPHS OMITTED** His Long-EZ, N63EZ, was parked, nose down, at his local airport within 50 feet of other airplanes and a metal hangar during a storm. As you can see from the photograph, the lightning vaporized the copper tape comm antenna under the skin of the left winglet and, in doing so, melted the blue foam core fully 2" wide and through to the outboard skin. The pressure of expanding gasses literally blew the inboard skin off the foam core and split the skin for almost 30". The rudder itself was undamaged and the structural attachment of the winglet to the wing was intact.

In addition to the above damage, his nav/comm was burned out, a handheld wired into the airplane was destroyed, the voltage regulator, intercom and strobe power supply were burned up, a digital CHT monitor, a digital fuel flow meter and bus voltmeter were destroyed. One co-ax antenna cable was burned. No other wiring was damaged. The lightning entered at the NG-3/NG-4 nose gear brackets, burning a 2" hole in the nose gear fairing, then ran around burning out the various electronic items and, finally, traveling outboard along the antenna co-ax and exiting from the tip of the left winglet. This is what we are told probably happened. Andy Plumber is a lightning expert and Burt has talked to him about this incident.

It is Andy's opinion that this was a very tiny lightning strike! He also informed us that had this strike occurred in flight that damage most probably would have been less, not more! He is absolutely adamant that no unprotected composite

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aircraft should fly within 50 miles of a thunderstorm!

We have a friend who works on a fleet of 4 C-130 aircraft and he tells us that at least one of these airplanes experiences a lightning strike on an average of once a month! Damage is usually small but occasionally results in an antenna being blown off the aircraft! There is even a report circulating that the recent loss of a similar C-130

(not one of his) was caused by a lightning strike which hit a fuel tank blowing the wing in half!

Lightning is not to be taken lightly, but for those who can afford it, there is a full, anti-lightning treatment available as written up in Sport Aviation on a Glasair III. A metal screen was bonded to every square inch of the airplane then it was struck by an artificial lightning bolt. There was some damage but mostly cosmetic. I cannot find the article right now but it is an expensive procedure and not something the average homebuilder would normally opt for.

This article is reproduced here simply to let all composite flyers know that flying close to thunderstorms could, quite literally, ruin your day! Stay clear of them, fly well around them, heck, that's the advantage of our canard pushers, we can fly around this kind of hazard with the excellent range we have. Fly safe and report any incidents to RAF so we can keep everyone informed.

CAUTION
Dick Rutan reported a failure of his starter solenoid recently. The problem was that the failure caused the starter to be permanently engaged! The solenoid welded itself in the on position so there was no way to shut the starter off! Fortunately, this occurred during normal maintenance with the cowling off. Dick saw the problem and shut down the engine. He has installed a "hung starter" amber light on his panel similar to what some general aviation aircraft have, and he highly recommends this precaution to anyone with an electric starter. Had this occurred during a start-up prior to a normal flight, he would not have known of the problem and the results could have been serious damage to the starter and ring gear and may have resulted in a fire!

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

LONG-EZ PLANS CHANGE
1/2"X.028" WALL STEEL TUBING NO LONGER AVAILABLE.
Ken Brock Mfg. has informed us that the 1/2"x.028" steel tubing called out for use in place of the original aluminum aileron control push rods is no longer available. They will supply 1/2"x.035" wall 4130 steel tubing from now on.

This means that the CS-50 steel inserts originally called out won't fit. Brock has changed the sizes of the CS-50 to ensure that these inserts do fit the 1/2"x.035" steel push rods. These inserts have a 10-32 thread machined into them to accept the dash 3 rod ends.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

ALL RAF DESIGNS

MANDATORY INSPECTION BEFORE NEXT FLIGHT.
If you use a 6" long or longer prop extension, remove the cowling and spinner and carefully inspect the prop extension using a strong light. Look for machine tool marks (chatter marks) in the two radii or a radius smaller than 1/4" or hairline cracking in the anodized finish in the radii. This is particularly critical if you have a Lycoming 0-360 engine. Discovery of any of these flaws is a ground-the-airplane problem. Contact RAF with a detailed description of your problem.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA
98237
206-853-8947

SHOPPING

FLUSH, INTERNALLY MOUNTED ANTENNAS
A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk. Contact:

Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00

Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel.
$40.00
Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	25.00
Go-A-Long-EZ	25.00

FOR SALE

F-16 DEEP STALL INCIDENT VIDEO
Gives a pilot's-eye view of a deep stall which almost doesn't recover. Includes a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall, as well as a transcript of the audio portion (for clarity).
Price - $13.00.

Contact: Charlie Precourt
7015 Little Redwood Dr.
Pasadena, TX 77505-4433

NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it. Contact:
Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $35.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

FOUR STACK STAINLESS EXHAUSTS
Further update on the all stainless steel 4-stack exhaust pipes. They are now available with springs and slip tubes at the flange or with ball joints, builder's choice, each still has the original slip tube support on each side to keep the pipes totally independent of each other. They have 1/4" type 321 stainless steel flanges and type 321 .035" stainless steel tubes. The tubes are "degreased" inside and out before they are purged or back-gassed with argon while being welded (others don't do these two very important steps). They fit Lyc. engines for any pusher aircraft, EZ's and Cozys, etc. - Cost - $500.00 plus $15.00 shipping and handling.
Also, if anyone would like to have ball joints fit and welded on their existing pipes, the cost is $150.00.
The RAM AIRBOX is still available at $325.00. Reusable foam air filter - $20.00 plus $11.95 shipping and handling.
The increase of performance of both 4-stack exhaust pipes and airbox combination is very impressive, about 200 rpm on the average Long-EZ installation. Builders can call or send SASE for a flyer. Both items come with an installation sheet.

Contact: Hal Hunt
6249 Longridge Ave.
Van Nuys, CA 91401-2528
818-989-5534

NOSE WHEEL SHIMMY DAMPER
Bob Davenport tells us that he can still supply this excellent damper. Unfortunately he gets very few orders nowadays but can sell them even if he gets only one order. Including the set up charge, the cost is $236.00 delivered in the USA.
Contact: Bob Davenport
PO Box 650581

Vero Beach FL 32965-0581
407-567-1844

NEW STARTER FOR 0-200 CONTINENTALS
B&C Specialty introduced a beautifully made, 12 volt starter specifically designed to be installed into the accessory housing on a Continental 0-200 engine, or on an 0-240. This starter has been thoroughly tested at Teledyne Continental (more than 5000 start cycles without a single problem!).

Bill Bainbridge has these starters available for immediate delivery and they can be had STC'd or for homebuilts.
Contact: B&C Specialty Products, Inc.
123 East 4th Street
Newton, KS 67114
316-283-8662

PS If you did not see this jewel at Oshkosh 1994, you should try to see one soon. They are really objects 'd art! ED.

0-235-C1 w/accessory case. Slick mags, starter, alt., fuel pump, vac. pump, carb AD'd, no prop strike, 1800 TT logs. Light rust found in cylinders. Needs TOH. $2200.00

62x66 B&T prop (60 hrs.).
3" extension.
Brock exhaust.
Air valve and intake elbow.
Call for prices on above items.
Contact: Francois Choquette
187 W Plumtree Ln. #61
Midvale, UT 84047
801-566-6102 (H)
801-565-4674 (W)

PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

Left to right: Woofter Mfg. prop extensions; 6" long, 8" long, both with 7" dia. prop flanges in bare aluminum. Normally these extensions are black anodized. 9" long Bob Beard/Mike Melvill design has 7" dia. prop flange but the dia. in the middle is 5" as compared to 3-1/2".

This is the failed prop extension. Failure occurred at the radius where the 7" dia. prop flange intersects with the 3-1/2" dia. barrel.

Bob Beard's original 8" long prop extension made from 6061-T6 aluminum.

Dan Worley's Long-EZ winglet after suffering a lightning strike while parked nose down on the ramp during a storm.

The Newton fuel cap. Solid aluminum anodized and polished - available with or without the locking feature - absolutely seals against fuel leaks with 'O' ring seals.

Bill Bainbridge's new Continental O-200 electric starter. Another beautifully engineered product from B&C Specialty Products.

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PHOTOGRAPHS OMITTED. PHOTO CAPTIONS ARE GIVEN BELOW

RAPTOR D-2. Second in the series of RPV aircraft by Scales Composites. Compare this photo to the cover of CP78 and note the obvious difference of the pilot's seating position. First flight 8-23-94.

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THE CANARD PUSHER No 80 Jan 95

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Back issues	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 80.
VariViggen (2nd Edition), newsletters 18 to 80.
VariEze (1st Edition), newsletters 10 thru 80.
VariEze (2nd Edition), newsletters 16 thru 80.
Long-EZ, newsletters 24 through 80.
Solitaire, newsletters 37 through 80.
Defiant, newsletters 41 through 80.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: RUTAN AIRCRAFT IS OPEN TUESDAY ONLY FROM 8:00 TO 4:00. When you call on Tuesdays, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

TWENTIETH ANNIVERSARY
Oshkosh 1995 will mark twenty years since Dick Rutan flew Burt's tiny proof-of-concept, VW powered VariEze to the EAA convention in 1975. Dick set out to fly non-stop, non-refueled from Mojave to Oshkosh. A broken oil cooler at Mojave and high oil temperature caused him to make a precautionary landing at Worthington, Minnesota. Dick did not refuel but did top off the very low oil and completed the flight the next morning, non-refueled.

Those of us fortunate enough to be there will remember the incredible excitement as the little glass canard was walked to its reserved parking space. Nothing like this flying machine had ever been seen at Oshkosh and it was totally surrounded by huge crowds every minute of the daylight hours that it was on the flight line. There is an excellent article in the October 1975 Sport Aviation, by Jack Cox, that

describes in detail the two record attempts flown by Dick during the week of the convention.

The second attempt was successful and N7EZ set a new world record flying 9 laps between Oshkosh and Menomenee, Michigan, a total distance of 1638 miles in 13 hours, 8 minutes and 45 seconds, an average speed of 125.5mph, using only 40.2 gallons of fuel. This is an average fuel consumption of only 3.1 gallons per hours!

This is all the more amazing when you consider that construction on this aircraft only began in January of 1975 and the first flight, by Burt, was accomplished on May 21, 1975! Actually less than 5 calendar months from start to first flight! Wow.

If you have the Sport Aviation, by all means read Jack's article, it really is exciting. If you don't have access to it and would like to read it, send a self-addressed, stamped envelope and we will send you a copy.

It is only fitting that this anniversary be recognized and if Paul Adrian, Norm Howell and a few others have their way, it certainly will be!

CP80, Page 1

GLASS OVERCAST 1995
To All Rutan Canard and Canard-Type Pilots Everywhere

It's a little hard to believe, but 1995 will be the 20th anniversary of the first VariEze to appear at EAA Oshkosh. To commemorate this event and to properly recognize the effect of Burt Rutan's designs on our sport aviation hobby, the following events are being coordinated by the Central States Association and the Experimental Aircraft Association:

A mass arrival of Rutan Canards at Oshkosh starting at 1000, Thursday, July 27th, 1995. The aircraft will stage from Racine Airport, fly a special arrival procedure, be announced to the audience at Oshkosh, and taxi to a specially designated area on the grounds.

A mass fly-by of Rutan Canards will also take place at this year's EAA Oshkosh convention during the Saturday and/or Sunday airshow, similar to what we have seen the T-34's and T-6's do.

Other events and recognition are to be determined, but you won't want to miss Oshkosh this year if you fly a "glass-backward". The sight of a mass formation fly-by is unlike any other in aviation. And aviation history will have never seen a fly-by quite like this one. We will need between 44 and 60 canard types to make it happen. You are invited to be a part, but:

To participate in the mass fly-by will require commitment and time on your part. Most EZ/canard drivers have not had the extensive formation instruction the warbird people have. There will be periodic and regular "Glass Overcast Formation Schools" held around the country by Central States Association regional coordinators, and you will be required to attend and be certified in a position by the coordinator.

Regional groups will get together for mass practices at airshows like Sun 'n' Fun, Arlington, the various RACE events, and so on. The first "dress rehearsal" will be at this year's CSA National Fly-In, the "Okie GIG", on June 9-11th at Page Airport near Oklahoma City. The second will be at Jackpot, Nevada, over the July 4th weekend.

Please take the time to consider this. Your participation in the "Glass Overcast" will be a memorable chapter in your enjoyment of these wonderful airplanes.

For more information, Contact:

Steven Sorenson, Glass Overcast Central Coordinator
11133 Glade Drive
Reston, VA 22091
703-860-2321

Terry Schubert, President and Newsletter Editor,
Central States Association
9283 Lindbergh Blvd.
Olmstead Falls, OH 44138

FIFTH ANNUAL GATHERING FOR CANARD-TYPE AIRPLANES
June 9, 10, 11, 1995

This year this popular fly-in is moving from Kansas City to the Clarence Page Municipal Airport (F29), Oklahoma City, Oklahoma.

Try not to miss this one, there will be social events, seminars, prizes and bull sessions and, possibly, formation practice for the Glass Overcast at Oshkosh, 1995.

Contact: Pete Peterson
4429 NW 48th
Oklahoma City, OK 73112
405-946-5003

A LONG TRIP IN A LONG-EZ
Andre De Berdt, from Sao Paulo, Brazil, flew his 0-235 powered Long-EZ from Sao Paulo to Oshkosh last year, a distance of more than 5000 nautical miles. Andre flew almost continuously for 4 days, much of it at night, using 170 gallons of fuel for an average of 29.5 nautical miles to the gallon (nearly 34 mpg!). His route took him around the coast of Brazil to Trinidad, over the West Indies to Florida, then on up to Oshkosh. Take a look at a globe - that is one serious cross-country!

As if that were not enough, Andre tells us he intends to fly to Europe this summer and, weather permitting, will return to Brazil via the North Atlantic to Iceland, over the North Pole to Alaska, then down through the USA and back from Florida to Sao Paulo! Wow, what a trip. Hopefully, we can persuade him to take photos and write an article for the CP. Long-EZ's are for traveling pilots!

MAGNA LISET - May 1935 - February 1994
We were very sad to hear from Magna's wife, Jean, that Magna was killed in his Long-EZ when he flew into power lines on Feb. 12, 1994. Magna was a gung-ho builder and flyer and we enjoyed him and Jean immensely when they visited California several years ago. As reported in the Canard Pusher, Magna achieved great things in his Long-EZ doing very well in the race around Australia, and set records flying coast-to-coast non-stop, in both directions, as well as from Australia to New Zealand.

We will miss Magna, he never took "no" for an answer and spent a tremendous amount of energy battling the Australian equivalent of our FAA over licensing his Long-EZ in the configuration he wanted. He got it done - he was quite a guy!

(I shall especially miss his midnight phone calls - ED.)

JOHN HAYES - Lost on October 9, 1994 while flying home from the Rough River Fly-In in Kentucky.

John was flying his Long-EZ, N33EZ, with Jack Fehling who was in his VariEze, N444EZ. About 15 miles northeast of Gadsen, Alabama, they encountered rain and Jack lost sight of John. He called John suggesting they land at Gadsen, but there was no response. John has never been heard from again.

The Civil Air Patrol initiated a search the following day and many friends participated. No ELT signal was received, even from the satellites, and no radar information was available. The area is heavily forested with pine and hardwood trees as tall as 60-80 feet. There are many ridges as tall as 2900 feet in the vicinity. The weather was 500' overcast with rain showers.

A rather massive search, both ground and from the air, failed to turn up anything and the CAP search and rescue was called off the first of November, 1994.

Our thoughts and prayers go out to John's wife and family members.

LETTERS
Dear RAF,
I am the Vice President of EAA Chapter 238 here in New Jersey and have served as Technical Counselor for almost 20 years. Over the last few years, I have become increasingly preoccupied with finding a better way of providing builders with faster and broader access to technical support. With that purpose in mind, eighteen months ago, I started an Electronic Bulletin Board specifically for sport aviation enthusiast across the United States.

Without having spoken to you previously about this technology, I am uncertain as to how much depth I should go in describing it to you. Stated simply, the North American Sport Aircraft BBS provides builders and Technical Counselors with a 24 hour on-line service. It is a dedicated interactive computer environment within which to communicate questions or problems related to building an aircraft and get them answered from a national pool of experienced people, not just local ones. There are no subscription fees or access charges. The service

is free. To date, the board has attracted calls from every major country in Western Europe including Scandinavia as well as from North American builders. It was this broad acceptance that prompted the recent improvements in software. It is becoming increasingly likely that the BBS will become a node on at least one international message network by January of '95.

Presently, there are 19 special conferences on this BBS:

1. Safety: Items of urgency
2. General Purpose
3. Composite Construction
4. Monocoque Construction
5. Tube & Fabric Construction
6. Ultralight Aircraft
7. Help! (Requests for support)

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8. Swap-N-Sell
9. Education: Books, Forums, seminars
10. Fuel Systems
11. Engines
12. Ignition Systems
13. Paint & Upholstery
14. Landing Gear: (Incl. floats & skis)
15. Avionics: (Incl. instruments & wiring
16. Resources: (alternate suppliers)
17. EAA Technical Counselor (private)
18. Government Activity: Fed, State, Muni.
19. Calendar of Events

Others will be added as demand warrants it. In addition, there are 7 file areas which contain files that can be down-loaded to the caller's computer and which will also accept uploaded files.

1. Flight Planning & Pilot Proficiency
2. Building Tips & Techniques
3. Aeronautical Design & Analysis
4. Newsletters
5. Disk Utilities
6. Manufacturers
7. Special Interest Groups

Recently, the system underwent a major change in software so as to make the environment easier for me to manage and to provide a greater scope of services for builders and pilots. I have also gone to great lengths to maintain an environment that is free of computer jargon and user friendly so that those not yet comfortable with this technology will find it easy and beneficial to use. An invitation is being extended to all known manufacturers and designers of sport aircraft to use the board as a fast means of contacting their building groups and end users, something obviously not possible with the typical monthly or quarterly newsletter.

I would appreciate your extending my invitation to EAA chapters and urge them to call the BBS and leave information regarding their chapter

activities. Ben Owen is aware of the BBS as is Jack Cox. There is hope that a complete national listing of Technical Counselors will be made available on disk media for posting so that builders will make better use of the TC programs.

I invite you to log on as well to see how it might support the EAA Chapter Office. The North American Sport Aircraft BBS can be reached by dialing 908-755-5371 any time, day or night with whatever personal computer you may wish. The BBS currently supports any modem from 1200 baud and up and uses an ANSI screen environment.

If you wish to explore other applications, please call me by voice line (908-755-9573). I'll try to give you whatever assistance I can that will further the support of homebuilders and their projects.

Sincerely,
Art Bianconi

This is a great idea and should be extremely helpful for builders. Many thanks for all the hard work, Art. ED.

ACCIDENTS AND INCIDENTS
A Cleveland, Ohio, Long-EZ pilot walked away from a crash which occurred shortly after take-off from the Cleveland Hopkins airport. The pilot did not build the airplane but reportedly had flown more than 400 hours in the airplane. Apparently, he had some sort of control system problem but the pilot said he did not know what had caused him to loose control and crash. The aircraft was severely damaged and the pilot was very fortunate to escape with minor bumps and bruises.

We are attempting to obtain more information on this accident but it does bring to mind the subject of loose objects in the rear seat. When flying solo, your preflight must include a thorough check of the rear cockpit for loose objects that may jam the control stick. It could be something as unlikely as lipstick or a pencil falling from the baggage strakes. This could have very serious consequences should the controls become jammed - preflight your airplane thoroughly!

SKY RANCH ENGINEERING MANUAL (SECOND EDITION) BY JOHN SCHWANER
This is quite simply the best book on the subject of air cooled aircraft engines that we have ever read. Covering a variety of subjects including engine inspection, engine performance, cylinder

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repairs, lubricants and wear, hose assemblies, trouble shooting, performance limits, vibration and balance, and an excellent section on fatigue analysis, this book is easy to read and understand. It contains valuable "gems" of information derived from a lifetime of overhauling engines and a hobby of studying failures. It is an absolute must for anyone interested in operating and maintaining a Lycoming aircraft engine. There is a complete list of all Lycoming engines in the Lycoming engine specification chapter.

There are many operational techniques described from how to start the engine through proper leaning, to taxiing and shutdown techniques, oil

and grease specification and uses, etc., etc. We highly recommend John's book.

Call: Sacramento Sky Ranch
916-421-7672

STATIC FUEL FLOW TESTING
In CP79, we reported the results of a thorough static fuel flow test conducted on Mike and Sally's Long-EZ, N26MS. This test was conducted at two fuel levels, tanks with half fuel and tanks almost empty. This was checked with the boost pump running as well as with the boost pump turned off.

The results have been questioned by several builders who generally agreed on the flow with the electric boost pump running but who could not achieve any flow at all with the pump turned off, even with a full tank of fuel!

Well, it turns out that there may be a plausible explanation. We have published static fuel flow results over the years from the prototype Long-EZ, N79RA; from Burt's Defiant, N78RA and from Mike's, N26MS. All of these aircraft had used engines in them which also had used, and probably quite old, mechanical fuel pumps installed on them. All of these pumps were manufactured before 1988. In 1988, Lycoming began manufacturing the AC mechanical fuel pump themselves. All of these pumps have 4 ounce springs installed at both the inlet and outlet of each pump. It takes about 1 psi to open one of these spring-loaded valves. In order to accomplish this, the fuel head would have to be at least two feet above the mechanical fuel pump. Actually, even with full tanks, we only have a little more than one foot of head on a Long-EZ.

AC mechanical fuel pumps manufactured prior to 1988 had only 1 ounce springs installed at the inlet and outlet valves. One ounce springs at the valves will allow about 5 gallons per hour of static flow. We believe this solves the mystery of why some builders have easily achieved the fuel flows called out in the CP and others could not achieve any flow (pump off).

Mike is close to a major overhaul on his engine and will conduct these tests, once again, with 4 ounce springs in the mechanical fuel pump and we will report the results here in the CP. With your boost pump turned on, you should have at least 20 gallons per hour of flow, even if you have the new mechanical fuel pump.

The electric boost pump (Facet Square pump) allows fuel to flow through it even when it is not running, the problem is in the newer AC mechanical fuel pumps. It may be possible to design a fuel system that by-passes the mechanical fuel pump, but keep in mind, that a system like this requires a check valve in the system and check valves, themselves, have spring-loaded valves that require some pressure to open so you may not gain any redundancy. You can take some solace from the fact that every low wing aircraft (Cherokee, Grumman Tigers, Cheetah, Mooney, etc.) suffer from the same situation and we are not aware of any of these aircraft having engine failures due to a double failure (both fuel pumps fail at the same time). We welcome any

feedback on this subject. As long as one, or both, fuel pumps are functioning, the engine will run to its maximum power capacity.

ENGINE MOUNT CRACKING
Reports of cracked Dynafocal engine mounts continue to come in - not a lot, but enough to cause concern.

A little history may be in order, to put things in perspective. The original VariEze, N4EZ, was powered by a Continental 0-200. The engine mount and the interface between the steel tube weldment and the fuselage was designed to handle

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up to the Continental 0-200. Later, several builders began to install the Lycoming 0-235 on the VariEze. A group of VariEze builders on the east coast did the first installation and structural analysis. Burt later checked out their work and approved this engine installation and, in fact, the Lycoming engine installation instructions were produced by this group, not by RAF.

When the Long-EZ was designed, the VariEze Lycoming 0-235 installation plans were used as the basis for the Long-EZ engine installation. There were no modifications to the steel weldment (mount) or to the interface to the fuselage (aluminum extrusions). The plans-built Long-EZ, including the prototype, N79RA, have exactly the same engine mount as the VariEze (which was originally designed for the Continental 0-200 which weighed only 190 lbs.)

Many builder/flyers have seen fit to install larger engines than authorized by the plans. These builders must realize that they have now taken on the responsibility of designing their own engine installation. RAF has not designed the Long-EZ engine mount to handle any engine larger than the Lycoming 0-235 or the Rolls Royce Continental 0-240.

Simply bolting a larger engine onto the 0-235 engine mount is asking for trouble. The extra weight and, more importantly, the extra vibrating mass of the engine/prop extension/prop may eventually result in cracks in the tubular engine mount.

By all accounts, the first indication is what feels, to the pilot, like a rough running engine. Should you notice a sudden, unexplained roughness or harshness from the engine compartment, land as soon as possible, remove the cowling and conduct a thorough examination of every tube and weld in the engine mount weldment using a strong light. If any cracks are found, do not fly again until this problem has been repaired.

What to do about this? Unfortunately, RAF is no longer in a position to be able to design and test a new engine mount so, it really is up to each builder/flyer. At the very least, a few well-designed gussets, strategically placed, or even a six point mount, may be required - are there any mechanical engineers out there willing to take on this task?

In the meantime, inspect your mount often and please report all incidents of cracking to RAF.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

LONG-EZ ALERT
Conduct a thorough inspection of your welded steel tube engine mount before next flight.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
600 Superior St.
Concrete, WA
98237
206-853-8947

SHOPPING

MOLDED VORTEX GENERATORS
CCI is pleased to announce the availability of pre-molded generators. Specially engineered for aircraft application, the 1" long by 0.40 high device is injection molded from U/V resistant polycarbonate material.

The design has been engineered so the "sail" is stiff enough to impart the desired energy into the boundary layer but flexible enough to resist breakage from "hangar rash" and the curious. Because they are molded from light weight polycarbonates rather than cut from extruded

aluminum, these pieces are less likely to cause injury, chip paint or cause propeller ingestion damage on pusher aircraft. Available in white, they can also be custom molded in quantity to match specific paint colors for aircraft manufacturers and OEM suppliers. Coloring does not compromise their ability to withstand harmful ultra-violet radiation.

The gluing surface of each generator is flexible and slightly concave to facilitate adhesion to either cambered or flat surfaces. The perimeter of each base is feathered to blend seamlessly onto the surface to which it is attached. After installation, the sail appears to be molded an integral part, rather than and "add-on". The final result not only looks better, it performs better than typical hand-made aluminum fences. Molded vortex generators adhere better, do not corrode, require no painting and are easy to install: one Long-EZ canard can be equipped with a full span of generators in less than 90 minutes.

Effective may 15, 1994, a kit containing fifty generators is available for a price of $25.00 plus $2.00 shipping and handling per kit. Two kits are sufficient to equip the full span of a typical canard (i.e. Long-EZ, Dragon-Fly, et al) or both ailerons on either canard or conventional planforms. Documentation is included. Please send check or money order to:

CCI
PO Box 607
Plainfield, NJ 07061-2318

Please allow 2-3 weeks for delivery, Sorry, no COD's. For more information 6:00-10:00pm EST, Mon.-Fri.
908-757-9573
908-755-9639 FAX

Note: These vortex generators are not TSO'd for use on type-certificated aircraft.

FLUSH, INTERNALLY MOUNTED ANTENNAS

A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk. Contact: Bill Butters

Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00

Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The

---

original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00
Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

NEW FOUR PIPE EXHAUST SYSTEM
Nat Puffer has designed and tested a new exhaust system for his Cozy. He tells us it will fit any pusher, including a VariEze or Long-EZ. There are slip joints at the flanges to prevent cracking and stainless springs are included to retain the exhaust headers into the short slip joints. These exhaust systems can be ordered directly from the manufacturer:

Custom Aircraft Supply
1318 Gertrude Street
San Diego, CA 92110
619-276-6954

$500.00 includes shipping, handling and packaging.

Nat has had good luck with a heat muff wrapped around both #2 and #4 exhaust headers. There may, or may not, be enough room in an EZ cowl to do this.

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00

RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	25.00
Go-A-Long-EZ	25.00

FOR SALE

TWO HENDRICKSON PROPS - never used - one is Maple, the other is Birch. Suitable for Long-EZ or VariEze with Lyc)-235, 108-118hp. Drilled to fit SAE-1 hubs, 3/8" dia. holes on a 4-3/8" bolt circle. These are beautiful props.
Call: Gerry Greer
206-364-4313 (Seattle area)

TITANIUM ACCESSORIES AVAILABLE!
Custom anodized in 15 different colors,
Rudder and aileron gust locks - $20.00-30.00.
GU canard full span vortex generators with layout template - $170,00.
These are hot looking !
Contact: Mike Rhodes
PO Box 1052
Grover Beach, CA 93483-1052
805-489-8155

F-16 DEEP STALL INCIDENT VIDEO
Gives a pilot's-eye view of a deep stall which almost doesn't recover. Includes a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall, as well as a transcript of the audio portion (for clarity).
Price - $13.00.
Contact: Charlie Precourt
7015 Little Redwood Dr.
Pasadena, TX 77505-4433

NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.
Contact: Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze.
$35.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

NOSE WHEEL SHIMMY DAMPER
Bob Davenport tells us that he can still supply this excellent damper. Unfortunately he gets very few orders nowadays but can sell them even if he gets only one order. Including the set up charge, the cost is $236.00 delivered in the USA.
Contact: Bob Davenport
PO Box 650581
Vero Beach FL 32965-0581
407-567-1844

NEW STARTER FOR 0-200 CONTINENTALS
B&C Specialty introduced a beautifully made, 12 volt starter specifically designed to be installed into the accessory housing on a Continental 0-200 engine, or on an 0-240. This starter has been thoroughly tested at Teledyne Continental (more than 5000 start cycles without a single problem!).

Bill Bainbridge has these starters available for immediate delivery and they can be had STC'd or for homebuilts.
Contact: B&C Specialty Products, Inc.
123 East 4th Street
Newton, KS 67114
316-283-8662

PS If you did not see this jewel at Oshkosh 1994, you should try to see one soon. They are really objects 'd art! ED.

0-235-C1 w/accessory case. Slick mags, starter, alt., fuel pump, vac. pump, carb AD'd, no prop strike, 1800 TT logs. Light rust found in cylinders. Needs TOH. $2200.00

62x66 B&T prop (60 hrs.).
3" extension.
Brock exhaust.
Air valve and intake elbow.
Call for prices on above items.
Contact: Francois Choquette
187 W Plumtree Ln. #61
Midvale, UT 84047
801-566-6102 (H)
801-565-4674 (W)

Doug Shane and Mike Melvill in close formation - a beautiful shot by Jim Sugar. **PHOTOGRAPH OMITTED**

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If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 81.
VariViggen (2nd Edition), newsletters 18 to 81.
VariEze (1st Edition), newsletters 10 thru 81.
VariEze (2nd Edition), newsletters 16 thru 81.
Long-EZ, newsletters 24 through 81.
Solitaire, newsletters 37 through 81.
Defiant, newsletters 41 through 81.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: RUTAN AIRCRAFT IS OPEN TUESDAY ONLY. When you call on Tuesdays, please make it between 8:00am and 11:00am and give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike.

RAF is no longer accepting multi-year subscriptions. Please renew only after your current subscription has expired.

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

1995 OSHKOSH SCHEDULE

FRIDAY, JULY 28
10:OOAM, TENT #3 - "LONG-EZ, VARIEZE & DEFIANT" - BURT AND MIKE.

SATURDAY, JULY 29 -
8:30AM, TENT #2, DESIGN COLLEGE - "FUTURE CONCEPTS FOR PERSONAL AIRCRAFT" - BURT.
10:00AM, TENT #3, "LIFE, UNIVERSE & EVERYTHING ELSE" - BURT AND JOHN RONCZ.
11:30AM, TENT #3, - JOHN RONCZ.

SUNDAY, JULY 30
8:30AM - DESIGN COLLEGE - JOHN.
10:00AM, TENT #3, "TENT TALK SHOW" - BURT AND JOHN.

EDITOR'S LAMET

Please accept my sincere apologies for not getting the April CP written and for being late with this July CP. I have been extremely busy with several jobs at Scaled that have caused me to put in 10 to 12 hour days, seven days a week, for the past several months. By the time I get home in the evening, I have been too tired to do anything but eat and sleep! My own Long-EZ is languishing in my hangar with the recently overhauled engine on the floor awaiting installation. I have, literally, not been able to find time to complete the installation.

I had Mattituck do a full up "red engine" major overhaul last March and I am looking forward to getting her back up and flying - hopefully that will be in time for Oshkosh '95 but right now, that seems questionable

Again, I am sorry about missing the April CP, I look forward to seeing many of you at Oshkosh. This year RAF will not have a booth so Burt and I should be able to spend more time at the airplanes just talking about operational problems and such. Burt will be flying his Defiant, N78RA, to Oshkosh since the Boomerang is not yet ready to fly (it is close, though). ED.

OTHER OSHKOSH NEWS

FROM CENTRAL STATES NEWSLETTER BY WAY OF MOM RUTAN:

The Hot Dog Roast will be held this year on Friday, July 28th after the evening airshow to allow more people to attend.

For details, check the notice board at the Flightline Homebuilder Building. (Note: RAF will not have a booth at Oshkosh this year).

GLASS OVERCAST 1995

TO ALL RUTAN CANARD AND CANARD-TYPE PILOTS EVERYWHERE:

This is to update you on the progress of the Glass Overcast events that are happening at Oshkosh.

The mass arrival is an event anyone with a Rutan or similar design can participate in, as long as they have a cruise speed of 120 KIAS, or better, at 3000 feet MSL.

The mass arrival briefing will start at 1000 SHARP!!! Thursday, July 27th, 1995 at the EAA Chapter 838 hangar at John H. Batten International Airport, Racine, Wisconsin. After the briefing, the

aircraft will stage from Batten Airport, fly in trail (NOT IN FORMATION) to a special arrival procedure, be announced to the audience at Oshkosh, and taxi to a specially designated area on the grounds. We will be parked all together just north of the Theater in the Woods, and there will be a special "Glass Overcast/Central States/Rutan" tent right in our parking area for our use!!

There is a block of rooms reserved for the night of Wednesday, July 26th at the Holiday Inn of Racine, which is within walking distance of the airport. Even so, there will be shuttle vans available to take you back and forth between the airport and the hotel. Just call 1-414-637-9311 (ask for Sheila) and mention the Central States Association to get the special rate on rooms.

If you want, you may go on to the convention site before Thursday and fly down in the morning on Thursday and fly back in with the group. Just don't be late to the brief! Remember, it's about 90nm from Racine to OSH.

The mass formation fly-by will occur during the Saturday afternoon airshow, on July 29th. This is an event not everyone may participate in. You must have been signed off by a Glass Overcast regional coordinator and have practiced with your group at least three times. The Western Region has already established 16 aircraft which can pass muster. Remember, a small flyby that looks professional is far better than a gaggle of unorganized, unwashed wannabes. Sorry for being blunt, but we are blazing a trail into the Oshkosh afternoon airshows for homebuilts, and we must make a very good first impression. 'Nuff said.

The mass fly-by of Rutan Canards will take place at this year's EAA Oshkosh Convention during the Saturday airshow. There will be a MANDATORY full dress rehearsal the day prior.

For those of you coming to Racine to join in the mass arrival, here is some additional information: The EAA Chapter 838 hangar is located on the west side of the airport next to the airport terminal building. The EAA Chapter will have coffee and donuts available for the early arrivals. Remember the brief time, it's 1000 sharp, Thursday, July 27th, 1995. DO NOT BE LATE! Racine is just south of the Milwaukee Class C surface area, so call in or stay clear. Also, it is just north of the Chicago mode C veil so grab your Chicago sectional (a current one) and note the location of Racine on the shore of Lake Michigan between Chicago and Milwaukee. Or you can just punch KRAC into your GPS and follow the steering.

Remember...the mass arrival occurs on Thursday, July 27th. Anyone can participate. The mass formation fly-by (a separate event) occurs on Saturday, July 29th, during the afternoon airshow. Participation is by qualified individuals only. Everybody got that? Good.

For More Information, Contact:
Steve Sorenson, 11133 Glade Drive, Reston, VA 22091 (703-860-2321) - Glass Overcast Coordinator.

Terry Schubert, 9283 Lindbergh Blvd., Olmsted Falls, OH 44138 (216-826-3055) - Pres. and Newsletter Editor, Central States Assoc.

Norm Howell, 4400 Knox Ave, Rosamond, CA 93560 (805-256-1643) - Glass Overcast Western Region Coordinator.

Gene and Ann Zabler, 48 Robin Hill Dr, Racine, WI 53406 (414-886-8315) - Wisc. State Rep., Central States Assoc.

Tim Bass, 719 Orchard St, Racine, WI 53405-2353 (414-632-0270) - Pres. EAA Chapter 838, Racine, WI (hangar tel. # 414-634-7575).

LETTERS

"Dear RAF,
Greetings from Houston... I had come across some information recently that would probably be of interest to EZ drivers and builders for your next CP.

I noticed in CP 79 your comments about using TCP to counter the effects of lead in the fuel. I had been suffering from sticking exhaust valves over the years in my 0-200 and finally had decided best to do a complete overhauls and install new (millennium) cylinders. The engine work was done by Dick Demars Aero in Fort Collins, CO. - they do excellent work and I highly recommend them to anyone contemplating an overhaul. At their suggestion, I've started using "Av-Blend" an oil additive that is supposed to be a big help in preventing exhaust valve sticking. Although it is too soon to tell (I've only 100 hrs. SMOH), I have been using it at each oil change and subjectively, (sound, smoothness) it seems to be helping. I'm told that TCP will help in the lead fouling area, but ultimately won't solve the "caking" of oil that occurs on the valve stems. The Av-Blend folks sent me some technical data on their product which I'm forwarding to you. I get mine from Engine Additives, Inc. in Humble, TX (800-672-7262), but it is produced by TechniFlyte Corp. in Chicago (800-209-0083). They've got some fairly impressive test results to back up their claims.

There are two very interesting NASA reports available to the public that were written in '85 and '86 on the results of the wind tunnel tests they did on the full scale VariEze and the 2/3 scale VariEze. One is about 80 pages, the other 60, and they are full of interesting data on the basic aerodynamic characteristics as well as the aircraft's stability and control parameters. I'm sure you at RAF have seen them - but it is not generally known that copies can be obtained by anyone wanting to add to their "canard-pusher library". They are excellent reference material for anyone flying an EZ. They are available through the National Technical Information Service by calling 1-800-553-6847. The first report is entitled "Wind Tunnel Investigation of the Flight Characteristics of a Canard General Aviation Airplane Configuration". The document number is NTIS No. N-87-10039. (NASA Technical Paper 2623). The second is entitled "Wind Tunnel Investigation of a Full Scale Canard Configured General Aviation Airplane (NASA TP 2382). The document number is NTIS No. N-85-19935. The only hitch is they aren't free - they are about $19.50 each, but they will take your order by phone at the NTIS 800 number if you use a credit card.

Deep Stall info update: I was perusing these wind tunnel reports recently when I noticed an interesting piece of data about high angle of attack characteristics of the EZ. I remember a couple of years back when we had our discussions about the Long-EZ deep stall incident that someone had asked about the possibility that engine power could aid recovery. At the time, I think we concluded it would not since the thrust line was basically through the cg. However, the wind tunnel data does show a fairly significant restoring moment is added in the pitch axis by going from idle to full power - about as much nose-down moment as the elevator provides, at the high angle of attach of a deep stall. A good piece of data to keep in your hip pocket should you ever encounter a deep stall inadvertently. Applying full power could aid in recovering an EZ - this is a characteristic of pusher prop configuration.

Well that's about all for now in the airplane department - I'm fully engaged in training for my next shuttle fight scheduled for this June. I've been assigned as pilot on the Atlantis crew with a mission to take two Russians up to the Russian MIR Space Station. We'll be making the first ever docking of a space shuttle with another space shuttle. Two 250,000 lb. vehicles will come

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together at little over 1/10th of one foot per second relative velocity. It's an interesting (and fun) flying task. This is also the first time we've docked with the Russians since Apollo-Soyez in 1975. We'll remain docked for 5 days and will leave the 2 Russian cosmonauts on board their MIR station and will bring home the 3 crew members who are up there now (2 Russians and an American - our first to fly on a Russian craft). They will have been there 90 days when we arrive so will probably be ready to come home. If all goes on time, I'll look forward to seeing you again at Oshkosh.

Fly Safe,
Charlie Precourt"

Ed. Note

We concur with Charlie on the use of engine power to aid in recovery from a deep stall in a canard pusher-type. In fact, we used this successfully on several occasions during high angle of attack testing of the Mercury aircraft, a development of the Microlite which was designed and built for Colin Chapman, Lotus Cars of England.

ACCIDENTS AND INCIDENTS

As always, the following reports are published for the sole purpose of helping others to avoid the same problems that caused the accidents.

BRUCE AND BONNIE TIFFT

Synopsis of Accident - N115EZ was a highly modified aircraft based on the Long-EZ.

Powerplant--although there was no data plate installed, this appeared to be a Lycoming IO-360-B series, angle valve, 200 HP engine.

The accident occurred on the morning of March 18, 1995 on the Tiller Trail Highway approximately 20 miles east of Myrtle Creek and 30 miles southeast of Roseburg, Oregon, only 55 miles from their departure point of Cottage Grove, Oregon.

Weather in the Roseburg area at the time was reported to be 3000 ft. overcast with good visibility. The overcast began to break up south of Roseburg and it was CAVU south of Myrtle Creek.

Based on all of the findings, it appears that the engine was not turning at the time of impact. Therefore, it is assumed that an engine related problem drove Bruce to attempt an emergency landing on this rather narrow mountain road near Tiller, OR. He appears to have approached from the south, made a left base to the west to line up on the road. The blacktop road bed is only 20 feet wide with approximately 6 foot wide shoulders on each side. There is a rocky hillside on the left side and a steep drop-off on the right, sloping down to Elk creek which roughly parallels the road. The airplane struck the tops of several pine trees which flexed and gave way but, unfortunately, the left wing then hit a large oak tree which tore this wing completely off the airplane. This caused the airplane to roll/yaw left where it impacted against some rocks in a nose low attitude, with at least 90 degrees of left roll. It then bounced/slid down the slope into the rain swollen Elk creek where it came to rest. Forward of the firewall, the fuselage was submerged. The engine cowling, engine, right wing and right winglet/rudder were not under water. Both occupants were killed instantly by the impact and did not drown.

The prop was stopped in the horizontal position. The right prop blade was completely undamaged, while the only damage to the left blade was that the outboard 8" was bent/broken straight aft, not at an angle against the direction of rotation as it would have been if the engine was turning or developing any power. This damage to the tip was caused by the left wing root as it was torn aft by the oak tree. There is evidence of yellow paint on the prop tip as well as on the left exhaust stack which was dented by the left wing root as it departed the airplane. The cowling was essentially undamaged, as was the right fuel tank/strake, right wing and right winglet/rudder. The engine was undamaged and still attached to the engine mount and firewall. The main landing gear also suffered little damage. The left side of the fuselage, aft to the centersection spar, including the left fuel tank/strake, was destroyed. The right fuselage side was destroyed aft to the leading edge of the right strake. The canopy was also destroyed. The instrument panel was heavily damaged, making it impossible,

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except for the radio, to determine the position of any of the switches. The control system was severely bent and even broken in several places, but all parts were recovered and all failures were due to massive overload. It is believed that the airplane was under control until impacting the oak tree and, it is the opinion of several of the

accident investigation team that the pilot would probably have landed successfully, if he had not struck the oak tree.

Considerable damage was done to the airframe by the salvage crew while removing the aircraft from the creek and transporting it to the police impound area in Myrtle Creek. Although this was taken into account during the investigation, we may have been able to learn a great deal more had the salvage been supervised by someone intimately familiar with this type of aircraft. The NTSB would not allow any examination of the wreckage by us until a representative from Lycoming, Mr. Greg Erickson, had completed his inspection. He, together with a representative from the FAA, arrived several days later, removed the cowling, and discovered that the engine had "non standard" cylinders, ignition systems and carburetor. Also, the engine data plate was missing. At this point he concluded his investigation and left. He later called Fergus Fay, who had requested to be present at the investigation (but was not notified) and told him of the "non standard" nature of the engine. He said that with no data plate, non standard cylinders, a non standard ignition system and "other modifications", he considered that it was no longer a Lycoming product. NTSB lost interest immediately, and within 48 hours the FAA turned the wreckage over to the insurance company who released it to the family who, in turn, gave permission to Ferg Fay to conduct an inspection of the engine.

Ferg removed the engine from the aircraft and transported it to his home where he suspended the engine in level flight attitude and drained the oil. There were only 3.8 quarts in the crankcase. The engine was initially very tight and it took a measured 1200 inch pounds of torque to break it loose. A compression check was conducted with the following results:
Cylinder #1 - 40/80 - leaking from the exhaust valve.
Cylinder #2 - 50/80 - leaking from the exhaust valve and the rings.
Cylinder #3 - 75/80 - slight leak by the rings but OK.
Cylinder #4 - 20/80 leaking from the exhaust valve and the rings.
The valve clearances were checked with the lifters compressed and were found to be between .028 and .066 (the Lycoming standard spec. is .028-.080). The three worst cylinders were removed (cylinder base nuts were found torqued to 450-500 inch/lbs.) and carefully checked with a micrometer and a dial indicator. The bore diameter and choke were consistent with Lycoming standards. Definite, light scoring was found in the upper cylinders. The top compression rings were removed from the pistons and the ring gaps were checked. They were found to vary from .010 to .040. These rings were found to have unusually sharp edges, particularly for so little running time.

There were no magnetos on the engine. The left mag hole was covered by an aluminum plate. In its place, a Jeff Rose electronic ignition system module was used. Instead of the right mag, there was an automotive type electronic ignition system of unknown origin. complete with distributor cap, rotor and automotive high tension cables. On disassembly, the distributor cap was found to be cracked and the center carbon was broken and found lying loose under the distributor cap.

Ellison throttle body (carb) looked OK but the throttle linkage had been bent during the crash making it impossible to move the throttle slide. There was fuel in the right fuel strake and, although the

linkage had been badly bent in the crash, the fuel shutoff valve was in the on position. When the fuel line was disconnected at the firewall, fuel ran out.

The crankshaft flange was checked, using a dial indicator, and the total indicated runout was only .002". The case was not disassembled because, at this point, the family sold the engine.

Analysis

Bruce had recently overhauled this engine using four new Superior millennium cylinders, pistons, valves, guides, etc. He had reported that the engine was running very hot but that it was using no oil! It is not normal for a newly overhauled engine to use no oil. The condition of the baffling verified the report of a hot engine. It was obvious

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that he had been working hard on tightening up all baffle leaks. There was an extraordinary amount of RTV all over the baffling and cylinders. We have learned that Bruce had ordered a new digital scanning cylinder head temperature gauge just the day before the accident (further indication that he had high temperatures). There are no logs to verify the engine running time since the overhaul but it is believed that he had only flown it about 5.5 hours before departing for Mojave, CA around 7:30am on March 18.

The crash site is 55 miles south of the Cottage Grove airport suggesting that they probably were airborne for only about 20 minutes. Assuming Bruce topped off his oil, which was his usual habit, how could he have used 3 to 4 quarts of oil in only 20 minutes? There were none of the usual signs of heavy oil use, the tops of the pistons were not heavily carboned up, nor were the exhaust stacks excessively oily or sooty. The light, but definitely noticeable, scoring in the upper portion of the new cylinders is indicative of tight rings; the unusually sharp edges found on the compression rings indicates excessive wear caused by tight rings and/or overly expanded pistons, caused by excessively high cylinder head temperatures. Compression ring gaps were measured at .010-.040 (Lyoming spec. calls for a minimum gap of .030-.045 in a nitrided, choked cylinder barrel). There is, however, no evidence that the engine actually seized (at least, in the cylinders).

Compression reading as low as 20/80 in essentially new cylinders is indicative of possible ovalizing of the barrels due to extremely high cylinder head and cylinder barrel temperatures. This condition would cause unusually high pressure in the crankcase due to ring blow-by and could have blown a lot of oil out of the breather. Since Bruce's breather system dumps into the exhaust system, all evidence of this loss of oil would be eliminated by being burned in the exhaust stack.

It could not be determined if the cracked distributor cap or the broken carbon existed prior to impact, so it is not known if the experimental ignition systems contributed to the cause of the accident. It is a fact, however, that if Bruce had suffered a complete electrical

failure, both of these ignition systems would have eventually cease to function. The battery was never found and it is assumed that it is at the bottom of the creek.

Summary

While weather was probably not a direct factor, the ceiling between Cottage Grove and Roseburg was reported to be around 3000 ft; we assume that he remained below these clouds. This would account for the fact that he did not have enough altitude to glide west to more favorable terrain. From 7500 ft, for example, he could have reached open, flat fields near Canyonville, east of Interstate 5. From 3000 ft, he was little more than a normal pattern altitude above the Tiller Trail, leaving him with no other choice. On reaching clear skies, southeast of Roseburg, he may have initiated a climb. Adding power at this point may have exacerbated the high cylinder temperatures problem and he may soon have felt compelled to reduce power to near idle. The engine might have stopped because of the internal friction evident by the upper cylinder scoring and ring wear. Had the engine been developing any power at all, it is certain that Bruce would have nursed it over to one of several airports that were less than 20 miles away., His radio was still on 122.8, the frequency used at Cottage Grove. He probably did not have time to switch to 121.5 and declare an emergency.

Bruce was the epitome of the experimenter and was always testing some new idea on his airplane. In this case, however, what with two different electronic ignitions systems, two different types of spark plugs, new design, relatively un-proven cylinders, a non standard crankcase breathing system, etc., maybe he was simply trying too many new things at one time. Bruce had a history of high oil temperatures with this engine, even before this latest overhaul, and he had installed a larger than normal oil cooler. This oil cooler was installed in an unusual position - just inside the engine cooling air inlet, in the cowling, where it looked as though it would impede the flow of cooling air to the cylinders. This is not a normal oil cooler installation and may have contributed to his high temperature problems.

Perhaps the lesson for those of us who fly these little airplanes is to try only one new idea at a time. We need to recognize the wisdom of FAA's requirement to test any "major alteration" in a

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suitable test area prior to returning to "normal" operations. Completely evaluate each new idea, one at a time, accept or reject it, then go on to the next new experiment.

Mike Melvill

PS. I have recently been in touch with the person who bought Bruce's engine and he has a few interesting observations. First of all, he says the weather in Cottage Grove that morning was much worse than the weather reported at Roseburg. He believes that there was no more than an 800 foot ceiling with poor visibility. Furthermore, he says at least one other aircraft departing from Cottage Grove to fly to

Roseburg that morning, was forced to return to Cottage Grove due to low ceilings and bad visibility.

While he has not torn down the engine, he did look at the mechanical fuel pump. He found that it contained only water, no fuel. This may, or may not, be significant. Since the aircraft ended up in a river, it is possible that the fuel system got water in it directly from the river. However, I can think of no way that water could get into a mechanical fuel pump if the pump is not operating, (The engine was not turning at impact) especially if the fuel lines between the mechanical fuel pump and the carburetor were intact. The same person, who has the hangar next to Bruce's on the Cottage Grove airport, says that Bruce fueled up his airplane the night before his planned flight to Mojave, by way of two Jerry cans. He had never seen Bruce do this before and it is possible that one, or both, cans may have had water in them. This scenario would require that only one fuel tank got contaminated by water and that they took off on the "clean" fuel tank, then switched to the tank with water close to the accident sight.

All of this is supposition, none of it is hard proof, and I am very sad to say that we may never know exactly what it was that caused us to lose our friends, Bruce and Bonnie. They were neat people and will be sorely missed by all of us in the sport aviation arena.

Mike M.

A Texas VariEze which was not built by this pilot but was purchased as a completed airplane, crash landed short of the runway due to a throttle control system anomaly that this pilot was unfamiliar with. This VariEze was equipped with an electrically operated nose gear system. Letter follows:

"On April 8th, my VariEze was force landed after the throttle stuck in the closed position while approaching Addison Field for a landing.

The pilot had been practicing formation flying with a Long-EZ flown by a friend. The pilot had been cleared for an approach, as a flight of two, into Addison. Approximately one mile from the runway, the tower requested that the flight reduce speed to the minimum possible to enable a twin on right base to land ahead of the flight. In complying with this request, power was reduced to a minimum. Shortly before this power reduction, the pilot noticed that the knob of the throttle control lever had dropped off. One part of the knob was retrieved and placed under the pilot's thigh for safety.

When the time came to open the throttle to maintain altitude and continue the landing procedure, it was found the throttle would not open more than a half inch. A determined effort to force the throttle open was unsuccessful. The limited opening provided insufficient power to maintain altitude and it was not possible to stretch the glide to reach the runway. It was difficult to try and resolve the problem and fly the aircraft safely at the same time, so the decision was made to concentrate on landing safely. A field that seemed to have fewer wires and other nasties, became the option. The landing was made safely and the aircraft rolled three hundred and fifty feet before being launched back into the air by a sharp rise in the ground. The aircraft then

flew over a road and landed on a bank on the other side of the road. The impact came with the plane level but descending almost vertically - what might be termed a genuine pancake. The distance between impact and final stopping place was about ten feet. Damage was extensive; nose gear, which did a great job in absorbing kinetic energy; main gear, folded back; and extensive damage to the fuselage in the attachment area. The landing gear fork, broken by the impact and then folded back under, came

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through the fuselage floor, through the thigh support and the seat and cut into the pilots right thigh. Far more destructive was the remains of the electric landing gear which tore loose and destroyed the instrument panel bulkhead, both the radio and transponder, the turn and bank as well as severely bruising the pilot.

The cause of the throttle problem: The aircraft had had a plans built cable throttle originally. This was later changed to a push/pull, Morse cable which was different from the original in requiring a straight motion from the bottom attach point of the lever. This was achieved by making a second lever, longer from the fulcrum to the lower attach point than the original but using the same fulcrum and control knob pattern. Instead of removing the original lever, the second lever was placed alongside the original, such that both moved together, although the original was now no longer functioning or attached to a cable. When the knob which went through both levers came off, there was no longer any restraint to prevent the levers from moving independently. One fowled against the other and jammed.

With more altitude and thus more time to fiddle around, the problem might have been overcome, or if the pilot had been aware of the way the system had been installed, he might have come up with a way to overcome the jamming. On the other hand, given the circumstance, making the decision without delay and maintaining control probably was a contributing factor in the limited damage the pilot and aircraft sustained.

I am concerned that builders who have installed electric nose landing gear activation may be in for a rude shock if they ever have an off field landing. The operating mechanism is heavy, and potentially a lethal weapon if it comes loose in an accident. I would strongly recommend to those contemplating the use of this gear to have another think. The only thing that saved me from injury from the gear was the almost zero forward speed on impact. I do not want to think about what that bloody great torpedo shaped missile would do to one in a frontal impact situation. When this aircraft is rebuilt, it will definitely have a plans built nose gear."

A Southern California Long-EZ crashed shortly after departing from the Santa Monica airport. The pilot survived but was badly injured.

A careful post-crash investigation revealed that this airplane's fuel system had been extensively modified by removing the engine driven mechanical fuel pump as well as the electric boost pump. The fuel

tanks had been plumbed together to form a gravity fuel system similar to a Cessna 150.

This pilot had also modified the front seat shoulder harness attach point and had installed a "Y" type shoulder harness, installed using a single bolt in the center of the seat bulkhead. There was no provision to carry the crash loads, no hardpoint and no beef-up of the bulkhead skins. The result was predictable. This single bolt pulled through the seat bulkhead and the should harness provided zero restraint. The seatbelts were installed per the plans and survived undamaged.

This is an absolute No-No! RAF Thoroughly explored the possibility of a gravity fuel system for the Long-EZ back in 1979 using the prototype, N79RA. Flight test results forced us to conclude that the margin of safety using a gravity fuel system was too slim and we opted to use a fuel system similar to a Grumman Tiger or Cherokee that includes two separately selectable fuel tanks, an electrically powered in-line fuel boost pump and an engine driven mechanical fuel pump. All of the above are mandatory in order to provide reliable fuel delivery to the carburetor on a typical Lycoming-powered Long-EZ,. This information was published in several Canard Pushers as well as in the plans and engine installation instructions. The following is taken from page 3 of the Section IIL of the Long-EZ plans:
"The most important item to consider is the mechanical fuel pump. The Long-Ez's fuel system is designed to require the use of an engine driven mechanical fuel pump, backed up by an in-line electric pump. This is a mandatory requirement and there is no acceptable way around it."

This important safety requirement was not just dreamed up, it was derived from a carefully conducted flight test program - do not try to second-guess the designer's motives behind critical systems such as the fuel system. The plans built fuel system on the Long-EZ is an

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excellent, trouble free system that is known to work on hundreds and hundreds of airplanes.

If you know of someone who may be contemplating a change to his or her airplane like this, get involved, help him or her out, don't let another unnecessary accident happen.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

NONE THIS ISSUE

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

RAF recommends the following prop manufacturer:

Ted Hendrickson
600 Superior St.
Concrete, WA 98237
206-853-8947

SHOPPING

MOLDED VORTEX GENERATORS
CCI is pleased to announce the availability of pre-molded generators. Specially engineered for aircraft application, the 1" long by 0.40 high device is injection molded from U/V resistant polycarbonate material.

The design has been engineered so the "sail" is stiff enough to impart the desired energy into the boundary layer but flexible enough to resist breakage from "hangar rash" and the curious. Because they are molded from light weight polycarbonates rather than cut from extruded aluminum, these pieces are less likely to cause injury, chip paint or cause propeller ingestion damage on pusher aircraft. Available in white, they can also be custom molded in quantity to match specific paint colors for aircraft manufacturers and OEM suppliers. Coloring does not compromise their ability to withstand harmful ultra-violet radiation.

The gluing surface of each generator is flexible and slightly concave to facilitate adhesion to either cambered or flat surfaces. The perimeter of each base is feathered to blend seamlessly onto the surface to which it is attached. After installation, the sail appears to be molded an integral part, rather than and "add-on". The final result not only looks better, it performs better than typical hand-made aluminum fences. Molded vortex generators adhere better, do not corrode, require no painting and are easy to install: one Long-EZ canard can be equipped with a full span of generators in less than 90 minutes.

Effective may 15, 1994, a kit containing fifty generators is available for a price of $25.00 plus $2.00 shipping and handling per kit. Two kits are sufficient to equip the full span of a typical canard (i.e. Long-EZ, Dragon-Fly, et al) or both ailerons on either canard or

conventional planforms. Documentation is included. Please send check or money order to:

CCI
PO Box 607
Plainfield, NJ 07061-2318

Please allow 2-3 weeks for delivery, Sorry, no COD's. For more information 6:00-10:00pm EST, Mon.-Fri. 908-757-9573
908-755-9639 FAX

Note: These vortex generators are not TSO'd for use on type-certificated aircraft.

FLUSH, INTERNALLY MOUNTED ANTENNAS

A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk.

Contact: Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes w/bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for

builder installation of an aluminum flat stock electrical panel.
$40.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:
Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

From CP81-10 (CH30)
FEATHER LITE HAS BOUGHT BRUCE'S EQUIPMENT FROM B&T PROPS AND WILL MAKE AN ANNOUNCEMENT SOON AS TO WHEN THEY EXPECT TO START PRODUCING PROPS. HOPEFULLY VERY SOON.

RAF "GOODIES" AVAILABLE

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (l7"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph	10.00
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	25.00
Go-A-Long-EZ	25.00

TITANIUM ACCESSORIES AVAILABLE!

Custom anodized in 15 different colors,
Rudder and aileron gust locks - $20.00-30.00.
GU canard full span vortex generators with layout template - $170,00.
These are hot looking !
Contact: Mike Rhodes
PO Box 1052
Grover Beach, CA 93483-1052
805-489-8155

F-16 DEEP STALL INCIDENT VIDEO
Gives a pilot's-eye view of a deep stall which almost doesn't recover. Includes a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall, as well as a transcript of the audio portion (for clarity).
Price - $13.00.
Contact: Charlie Precourt
7015 Little Redwood Dr.
Pasadena, TX 77505-4433

NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.
Contact: Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

SIGHT GAUGES
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $35.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

NOSE WHEEL SHIMMY DAMPER
Bob Davenport tells us that he can still supply this excellent damper. Unfortunately he gets very few orders nowadays but can sell them even if he gets only one order. Including the set up charge, the cost is $236.00 delivered in the USA.
Contact: Bob Davenport
PO Box 650581
Vero Beach FL 32965-0581
407-567-1844

NEW STARTER FOR 0-200 CONTINENTALS
B&C Specialty introduced a beautifully made, 12 volt starter specifically designed to be installed into the accessory housing on a Continental 0-200 engine, or on an 0-240. This starter has been thoroughly tested at Teledyne Continental (more than 5000 start cycles without a single problem!).

Bill Bainbridge has these starters available for immediate delivery and they can be had STC'd or for homebuilts.

Contact: B&C Specialty Products, Inc.
123 East 4th Street
Newton, KS 67114
316-283-8662

PS If you did not see this jewel at Oshkosh 1994, you should try to see one soon. They are really objects 'd art! ED.

0-235-C1 w/accessory case. Slick mags, starter, alt., fuel pump, vac. pump, carb AD'd, no prop strike, 1800 TT logs. Light rust found in cylinders. Needs TOH. $2200.00

62x66 B&T prop (60 hrs.).
3" extension.
Brock exhaust.
Air valve and intake elbow.

Call for prices on above items.
Contact: Francois Choquette
187 W Plumtree Ln. #61
Midvale, UT 84047
801-566-6102 (H)
801-565-4674 (W)

FOR SALE

Removed from Long-EZ, N26MS, in order to install a new Allegro CHT/EGT engine analyzer:

2-1/4" digital EGT/CHT gauge by Electronics International. Includes a 4-way switch and all necessary wires and CHT and EGT thermocouples (bayonet-type CHT probes) -- $150.00

Also, 2-1/4" Electronics International digital volt/amp meter. Includes shunt and installation manual. Original cost, $148.00 - only $60.00.

Contact: Mike Melvill
24120 Jacaranda Dr.
Tehachapi, CA 93561
805-821-1805 (H)
805-824-4541 (W)

How about this for something from the past! Circa 1974 (?) A young Burt - first flight - up and away - of his original VariViggen prototype. Note wingtip end plates and lack of cowling. **PHOTOGRAPH OMITTED**

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THE CANARD PUSHER No 82 Oct 95 Last issue

DAYTON - Friends and family staged a surprise for Burt Rutan earlier this year when they showed up unexpectedly in Dayton, Ohio.

After all, Burt's induction into the National Aviation Hall of Fame was an event his friends didn't want to miss.

Burt's portrait will now hang in the same hallowed halls as aviation greats Orville and Wilbur Wright, Scott Crossfield and John Glenn, among others.

The National Aviation Hall of Fame, which is dedicated to honoring and preserving the history of outstanding air and space pioneers, was formally approved by Congress and President Lyndon B. Johnson as a national organization on July 14, 1964.

While Burt was one of four men inducted into the Hall of Fame this year, he was the only one still living. "Ace of Aces" Dominic Gentile, the flying hero who single-handedly shot down thirty enemy aircraft during World War 11, was later killed in a T-33 trainer crash at the age of 31. Clyde Pangborn, the barnstorming pilot who once climbed out of the cockpit during a trans-Pacific flight to free a frozen wheel strut, was buried with military honors at Arlington National Cemetery in 1958.

Aeronautical engineer Harold Pitcairn, born long before the first flight of the Wright brothers, and whose commercial aircraft designs eventually led to the development of Eastern Airlines, had also "slipped the surly bonds of earth."
Friends and family members accepted awards on behalf of Gentile, Pangborn and Pitcairn.

Burt said he was thankful to be able to accept the prestigious award in person, in front of friends and family.

Burt was joined in Dayton by wife Tonya; niece Jill and her husband Air Force Captain Larry Hoffman, as well as friends Mike and Sally Melvill, Tehachapi; Emile and Kaye LeFebvre, Tehachapi; Dan and Margarite Cooney, Tehachapi; Greg and Krizzi Garrett, Tehachapi; and Chuck and Joan Richey, Mojave.

"The 151 enshrinees so honored represent the history of flight," wrote Hall of Fame president Dennis Corbly, "and include some who dreamed of its possibilities, some who gave their lives in its cause, some who made it practical reality, and some who have shown the way to the limitless. universe."

Long-distance pilot Andre Deberdt gives pals a tour of "OL' ZAD." (l-r) Andre, Mike and John Campbell. **PHOTOGRAPH OMITTED**

Oshkosh or bust by gosh
One of our South American friends reproduced the flight of an aviation hero, set four new records and entertained air show tourists in the U.S. with Long-EZ antics all within four months.

Brazilian pilot, Andre J, Deberdt, began the adventure in his hometown, Sao Paulo on April 21, '95. After landing his 1989 Long-EZ in Natal, Brazil, the native Frenchman. who has lived in Brazil for forty years, took off for a long-distance flight across the Atlantic Ocean to Dakar, Senegal on the African coast. Flying at an average speed of 130 Kts, Andre covered 1627 NM in little over twelve hours. That was the first leg of a four month odyssey that swept him across the Atlantic four times, through Africa and parts of Europe, over Iceland, Canada, and eventually landed him in Oshkosh, Wisconsin for the annual fly-in.

PPZAD, or "0l 'ZAD" as the airship is affectionately called, is the first Brazilian experimental homebuilt to fly from Brazil to Africa non-stop and to tie South America to Europe with only one fuel stop.

Joao Ribeiro DeBarros, a famous Brazilian pilot who made the Atlantic crossing in a twin-engine Amphibian Savoria Marchetti on April 28, 1927, served as prototype-pilot for the early part of Andre's voyage. "What is little known is that DeBarros made the crossing 22 days before Lindbergh," Andre explained. "But the difference was that Lindbergh was flying (between) two important cities, New York and Paris, and also he had the American media, which was very good. This poor guy had little media. At the time he was famous, but the Brazilian don't seem to have memory for their hero. I am trying to change that."

Andre waited two days on Isl de Sal in the Cape Verde Islands just to cross on the same date as DeBaffos - April 28th. "Looking at the weather, of course," he added.
Andre chose to cross the ocean by night. "As Dick (Rutan) told in his forum, what you do not see, you do not fear," he explained with a hearty laugh, "it's psychology." The shorter nights while traveling east and the ability to spot far-off lightening and heavily traveled traffic patterns also played a role in his decision. "By night it is cooler, and the engine works better," he said. "You can fly at higher altitude, and the sight is just beautiful."

An intelligent, gregarious guy, Andre had no problems making friends and influencing people even while crossing the wild blue yonder at an average of 12,000 feet. "Anytime I could not contact the controls by HF radio, I called on International Emergency Frequency and asked the big boys over there to help me, and use their radar," he said. "There are many airplanes crossing at the same time. You get many, many answers every time you call. One of them, from Swiss Air, had a Long-EZ so we were discussing the virtues of each EZ for an hour or so."

Foreign flying permits were relatively easy to come by, according to Andre, who serves as a judge for a Brazilian Rally team as well as an International judge for the FAI. "In South America (it is) completely free, as easy as here in the United States," he said. "The difference being that taxes are high and fuel more expensive, but it's a simple matter of filing an international flight plan."

Andre said there are four Long-EZs, two Cozys and one VariEze flying in Brazil. Two Velocitys are currently under construction.

He was only questioned once during his sojourn, while trying to fly over Morocco. "Three hours into the flight after leaving Tenerife,

Canary Control called me and told me, 'Casa Blanca wants to know if you have permission to overfly their country.' And then I answer with another question, 'Ask them if they know that it's the new regulation of International Organization for Civil Aviation (IOAC)?'

"But there was no way. They wouldn't let me overfly the country, So I had to discuss with Spanish Authority (a way to) vector me direct to Spain."

Andre said the airplane never failed, but he lost his ADF and Altitude Encoder at one point, landing by GPS and the feel of the airplane. It was repaired by RMI as soon as he arrived in the States. "The NARCO ADF was also repaired there," he said, "and I had to transfer the NDB data's for the IFR landing procedure in Iceland into the data base of the GPS, and I then completed the instrument landing there with no problems."

As for the 118 hp Lycoming 0235-L2C engine, "it works like a fine Swiss watch," he said. "I have the Klaus ignition, of course, and that is a big factor in the fuel efficiency."

A surprise encounter with ice south of Greenland was a new experience for Andre. Flying at 12,000 feet with a headwind, Andre said he felt that the airplane was a handling nose-high. While he noticed a little rime ice on the leading edge of the wing and the winglets, he did not consider it a significant problem. However, a short flight-test soon shattered his calm. The airplane shuddered, forcing Andre to cut power and descend to 8,000 feet. "Then suddenly I heard two big, loud bangs," he said. "After a while I figured out I had much more ice on the canard that I couldn't see, of course. It melted and (left) the wings. I had an aft CG, and I almost entered a deep stall because of that. This was quite an experience."

"I once had an experience of icing of gasoline over Chile in 1993. I lost my engine. Mike Melvill had the same problem over Alaska. He told me "Well, you are from the tropics. You do not know this phenomenon. At the high latitude it happens frequently." Since then I was careful to add some additive to each leg over Iceland just to avoid icing."

After the Iceland episode, Andre made a stop in Gander,Newfoundland before heading to Oshkosh.

"I was not going to come to Oshkosh '95," he said. "But Terry Schubert (President & Editor, Central; States Association) told me you cannot do that, you have to be part of our team for the Glass Overcast."

Indeed, he did. Andre and ZAD flew as part of the Lone Eagle Flight Team's display during Saturday's air show.

Andre, who is married with two daughters and two granddaughters age 13 and age 6, said he claimed four more distance records, which are about to be confirmed. by the FAI, as he headed home from Oshkosh to Sao Paulo. The return home was uneventful, he reported, and "very enjoyable if not a bit tiring."

For now ZAD is temporarily grounded "by popular demand - my wife," he said, for a much deserved rest. But in 1997 Andre plans to fly the long-distance courses again, this time to close the loop through Australia.

Good luck Andre, we will listen for you on the airwaves.

All-star line-up on stage --- (l-r) Burt, Atlantis pilot Charlie Precourt; astronaut Greg Harbaugh; astronaut Bonnie Dunbar; John Roncz. **PHOTOGRAPH OMITTED**

'95 Oshkosh tapes for sale

Shuttle pilot Charlie Precourt and the Atlantis crew were a few of our aviation favorites who shared the microphone on stage with Burt at his infamous Oshkosh tent talks this summer.

Mike Melvill joined Burt for a history of the Rutan canards and John Roncz shared the mic for the annual John and Burt Tent Talk Show.

The following audio tapes are available for your listening enjoyment:

Tent Talk Show by Burt Rutan and John Roncz; July 30, 10 am, Tent 3.

Future Concepts for Personal Aircraft by Burt Rutan; July 29, 8:30am, Tent 2.

Life the Universe and Everything Else by Burt Rutan and John Roncz; July 29, 10am, Tent 3

Can Dragons Fly? by John Roncz; July 30, 8:30am, Tent 2.

VariEze, Long EZ, Defiant and VariViggen by Mike Melvill and Burt Rutan; Friday, July 28, 10am, Tent 3.

Human Elements on Long Duration Flights by Dick Rutan; July 30, 11:30am, Tent 3.

Copies of these tapes and others are available for $8 each from Forum Recordings, 3410 St. Peters Rd, Marion, Iowa 52302, or telephone (319) 377-4188.

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Editor: Mike Melvill
Publisher: Tonya Rutan
(805)824-2645

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RAF is no longer accepting multi-year subscriptions. Please renew only after your current subscription has expired.

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Ed) CP 1 to current
VariViggen (2nd Ed) CP 18 to current
VariEze (1st Ed) CP 10 to current
VariEze (2nd Ed) CP 16 to current
Long-EZ CP 24 to current
Solitaire CP 37 to current
Defiant CP 41 to current

A current subscription of the Canard Pusher is mandatory for builders, as it is the only formal means to distribute mandatory changes. Reproduction and distribution of the Canard Pusher is approved and encouraged.

Glass Overcast
blast from the past

PHOTOGRAPH OMITTED

The old trusty Defiant N78RA ferried Burt, Tonya, Mike and John Campbell (Scaled engineer) safely to and from Oshkosh '95.

For the first time in 15 years, Mike and Sally's N26MS Long-EZ did not make it to Oshkosh. Built in 1980, N26MS has been to Oshkosh every year since 1981. This year it was not to be.

Mike and John Campbell worked very hard installing the newly over-hauled engine, and were putting as many hours on it as possible prior to departing for Oshkosh, when, just the day before leaving, the oil pressure abruptly went away! Immediately all energy was transferred to preparing Burt's Defiant for four passengers instead of two, and early the next morning we departed Mojave via the Trona Gap, a small passage-way between the restricted areas of the Navy's China Lake and Edwards Air Force Base.

The GPS driven moving map on the laptop computer (Mentor Plus) made this task easy, and from there the route was GPS direct, over Las Vegas towards Oshkosh. The only stop was at the tiny town of Cambridge, Nebraska, where the FBO lent us his wife's car. Tonya drove us into town where we had excellent country style food at the only restaurant.

Cambridge is a neat little town, and the people are friendly. It's an excellent place
to stop for gas if you are in the area.

After lunch we flew GPS direct to Racine, Wisconsin where we spent the night. We enjoyed a fun evening and supper with the 60 or so other canard owners courtesy of EAA Chapter 838 in Racine. Great pizza, great company.

Early the next morning more than 60 composite canard aircraft took-off from the John H. Batten (RAC) runway, after a pilot's briefing held by Maj. Norm Howell, for a 90-nm in-trail mass arrival at Oshkosh led by Burt flying "Mother Ship," Defiant N78RA. Anyone with a Rutan or similar design was allowed to participate, as long as they had a cruise speed of 120 KIAS or better at 3000 feet MSL.

After being announced to the Oshkosh audience (according to EAA estimates, 830,000 people and more than 12,000 airplanes showed up for Oshkosh '95), the canard flock taxied to a specially designated area north of the Theater in the Woods.

In addition, to help celebrate the 20th anniversary of the proof-of-concept VariEze N7EZ, 28 composite aircraft swept the field in professional formation at Saturday's air show while five pilots gave the audience a taste of the canard right stuff for the first time in 10 years with a five-plane flying show - Ron Smith in his Variviggen; Andre Deberdt in his Long-EZ; Marty Pavlovich in his VariEze; Terry Krouch in his Quickie; and Mike in the Defiant.

Glass Overcast 1995 was a great effort organized by Steve Sorenson, Glass Overcast Coordinator; Terry Schubert, President & Editor, Central States Association; Norm Howell, Glass Overcast Western Region Coordinator; Gene and Ann Zabler, Wisconsin State Rep, Central States Association; and Tim Bass, President EAA Chapter 838, Racine WI.

RAF thanks them and all the pilots who spent hours of practice preparing to put on the "greatest show on earth" at the greatest air show on earth."

RAF HOURS: Rutan Aircraft is officially open Tuesdays only. Please call between 9 am - 12 am and give your name, serial number and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike.

Note - Sometimes you can catch Tonya at RAF Monday thru Friday. She is in and out. Try and try again.

When writing to RAF, send along a stamped, self addressed envelope, if you have builder's questions that need to be answered. Please put your name and address on the back of any photos you send.

PP ZAD's Journey to Europe and Oshkosh '95.

LEG	DATE	ROUTE	NM	SPEED	EET
1	Jul 2	Marte SP Brazil - Natal RN Brazil	1283	135	09:30
2	Jul 4	Natal RN Brazil - Tenerife Canary Islands	2342	130	17:57
3	Jul 7	Tenerife Canary Islands - Castellet France	1489	142	10:30
4	Jul 13	Castellet France - Strasbourg France	430	139	03:06
5	Jul 15	Strasbourg France - Lelystad Holland	292	146	02:12
6	Jul 16	Lelystad Holland - Lille France	181	136	01:30
7	Jul 18	Lille France -Valence France	360	135	02:54
8	Jul 18	Valence France- Castellet France	160	137	02:24

9	Jul 22	Castellet France - Moulins France	229	134	01:41
10	Jul 23	Moulins France - Herning Denmark	642	121	05.10
11	Jul 25	Billund Denmark - Reyjkavik Iceland	1047	125	08:24
12	Jul 26	Reyjkavik Iceland - Gander Canada	1385	121	11:28
13	Jul 27	Gander Canada - Oshkosh USA	1494	126	11:47
14	Aug 3	Oshkosh USA - Ft. Lauderdale USA	1200	107	11:08
15	Aug 6	Ft. Lauderdale USA - St.Martin Carribean	1114	134	08:18
16	Aug 9	St.Martin Carribean - Belem PA Brazil	1470	122	11:55
17	Aug 12	Belem PA Brazil - Marte SP Brazil	1356	131	10:20

Total IFR Enroute 16,474 NM(30,510 KM)-130:14 HOURS-126.5 KT AVG (234.4 KM/H)

Surfing the Net

Internet has some EZ info. Burt recently posted the following letter on America Online Clubs - Interests - Aviation - Forum - General Aviation - Homebuilts, Long-EZ & VariEze Message Boards. **SKETCH OMITTED**

While I am far too busy to keep up a continuous dialog on this news group I do think I should respond to some of the info out there!

I've been surfing the postings and see a lot of wrong stuff (abet mixed with some very good info). I offer the following to update those EZ guys that somehow don't get the quarterly Canard Pusher newsletter.

Yes, we still support EZ licensed builders and flyers. even now, 10 years after we sold the last set of plans. If you are licensed by RAF to build an EZ (several thousand people) we still here to help in any way we can to assure that you have the best chance to fly safely. We do not support second-party plans owners or bogus (Xeroxed) plans owners, so if you buy a set of plans from a licensed builder, be sure to get his agreement to support you. Remember he is still authorized to build ONE aircraft, and we will support him. He, if he wants, can sell ANYTHING to you, If you buy a used set of plans we suggest that, along with the plans, you get his agreement to license you and to support your project, since he is the only RAF licensed manufacturer.

The CP is still in publication, written chiefly by Mike Melvill, the primary builder support guru since 1978. It still is my official means to pass on plans changes and important safety info. CP #82 (Oct 95) is a bit late, because it is being revamped to an all-new format (my wife Tonya is the new editor). It's 16 pages are packed with interesting stuff including several MAND-GROUND changes that Mike Melvill and I think everyone should have. A CP subscription is available to anyone, not just licensed builders.

Also strongly recommended are the Oshkosh talks.

In general, RAF only supports the basic, unmodified versions of the aircraft, since that is all we have flight-tested. Many mods have been done by builders (bigger engines baggage pods etc, etc, etc). Many of

these MAY be OK, but to find out for sure, contact those who developed them, NOT RAF.

We are painfully aware of how difficult it is for everyone to keep up with every single improvement and revision. The words of the newsletters alone comprise about 4 megabytes. That is why we are in the process of putting together a CD-ROM. This will be a special product since it will include not only the newsletters but also pilot's handbooks, tech reports, and even the plans of all the RAF homebuilts since 1972! (No, it will not include new licenses to build - the postings here accurately explain why we stopped that).

The CD-ROM will have thousands of illustrations, photos and a great search engine. If You are a CD-ROM developer/producer, contact us for an RFP, by faxing your address to (805)-824-4174.

RAF is open on Tuesdays ph (805) 824-2645 addr 1654 Flightline, Mojave CA 93501

Onward & Upward, Burt Rutan

PS: No, the Boomerang is not yet flying, I hope to finish it this spring. I WILL post the first flight report here on America Online.
PPS: Check out the postings on the BD 12/14, shades of 1971!!

The Voyager round-the-world flight can't be licked! That is, unless it appears on a commemorative postage stamp in 1996.

You can help launch our slender airplane again, this time from the upper corners of letters and packages all across the United States. Mail the following letter, or a similar one penned by your own hand, to the Citizens Stamp Advisory Committee today. Thank you!

Citizens Stamp Advisory Committee
United States Postal Service
475 L'Enfante Plaza SW Room 4474E
Washington D.C. 20260-5753

FROM: _____
_____
_____
_____

Ladies and Gentlemen,
It is my desire to request our consideration of a commemorate postage stamp for 1996 depicting the famous Voyager; the airplane that flew around the world non-stop and unrefueled in December 1986.

The Voyager project radiated American Spirit. The historic aircraft is now proudly suspended in the National Air & Space Museum in Washington D.C. and is an emotional reminder that even the impossible is possible.

Please honor those who made the flight possible -- the Voyager flight crew, the volunteers and the grassroot support that funded this

impossible dream, by issuing a ten-year anniversary commemorative postage stamp in 1996, ten years after the infamous flight.

Thank you for your consideration.

Sincerely,

_____Date_____

Canards take Oshkosh by storm
This year Rutan canards filled the skies over Wisconsin like a flock of regal birds heading Midwest for the summer. They flew to Oshkosh to celebrate the 20th anniversary of the 7-EZ. the "Ass Backwards" prototype that wowed that aviation-loving crowd for the first time in 1975.

We here at RAF applaud two people for their devoted efforts to count the flock. It was a big job, as you can see from the following list compiled by Irene Rutan and David Orr - 161 Rutan canards in all.

Thank goodness for friends and mothers.

*Participants in Glass Overcast.
Variviggen N31AN (Adam Wehr III) FL
Variviggen N212RS (Ron Smith) IN
Variviggen N77AX
Defiant N219DF (Lonnie Weitzel) TX
Defiant N711JS (Bill Sattler) TN
Defiant N143PS (Bill Sattler) TN
Defiant N78RA (Burt Rutan) CA*
Defiant N431RA (Bayard Dupont) DF LA
Defiant N3XK (Tom Kuffel) MT
VariEze N7AH (Larry Hoepfinger) TN
VariEze N115AM (Bob Campbell) IN
VariEze N13OBE (Bob Eckes) AZ
VariEze N12BN (Bernard Nitz) IL
VariEze N300DJ (Don Jones) TN
VariEze N862DP (Dan Patch) CA
VariEze N50EP (Edra Parker) IN
VariEze N7EZ (EAA) WI
VariEze N17EZ (Dick Harkey) OK
VariEze N83EZ (Terry Sweat) TN
VariEze N216EZ (Wm Morgan) OR
VariEze N392EZ (William Freeman) KS
VariEze N500EZ (Victor Mondary) IN
VariEze N9FJ (Jon Gabrick) MN
VariEze C-GMEZ (Nigel Field) Canada
VariEze N341HA (EAA) WI
VariEze N64HL (Howard Stern) CA
VariEze N83HR (Harry Robbins) MO
VanEze N60HZ (Bruce Leonard) OH
VariEze N91JC (James Carraway) CA
VariEze N844JF (JD Hostutler) TX
VariEze N26JW (Gary Holt) OK
VariEze N47LG (Dave Kilbourne) CA*
VariEze N6LK (Rob Martinson) CO

VariEze N40LR (Leon Rausch) TX
VariEze N79RA (Burt Rutan) CA
VariEze N56RH (Bob Head) CA
VariEze N301RW (Bob Woodall) MD*
VariEze N118SJ (Steve Sorensen) CA

Canards

VariEze N301SR (Stan Rawlings) WA
VariEze N810TC (Martin Pavlovich) WI
VariEze N12VE (Joe Bennight) TX
VariEze N44VE (Joe Rosa) MO
VariEze N829WJ (Dave Nelson) MN*
VariEze N75WR (William Ingram) CA
VariEze N2XB (Kurt Kuhlmann) CA
VariEze N4ZX (John Cannon) TX
VariEze N4ZZ (Ken Swain) IL*
VariEze N9091A (Gary Mowad) CO
VariEze N9113A (Wm Brin) CA
VariEze N3260K (Doug Kouri) Ml*
VariEze N5080K (Chuck Airesman) MD
VariEze N930L (Richard Zadow) TX*
VariEze N1158M (Maxey Hester) IA
VariEze N8037T (Jim Willer) CO
VariEze N183W (Bill Oertel) CA*
VariEze N303Y (Joe Krueger) WI
VariEze N9664 (Burt Carmenzino) CA
Long EZ N60AK (Gerald Nibler) AK
Long EZ N57AM (Alex Becker) Ml*
Long EZ N775AM (Sam Chambers) KY
Long EZ N41AN (Ian Ayton) CA
Long EZ N454BC (Brad Carter) KS
Long EZ N89BE (Robert Englert) CT
Long EZ N82BJ (Bob Wilson) CO
Long EZ N73BR (Brent Bristow) AK
Long EZ N199BW (Barry Weber) CA*
Long EZ N52CA (Chuck Allison) MN*
Long EZ N18CC (Larry Laughlin) CA
Long EZ N143CL (Chuck Busch) CA
Long EZ N8CP (H.E. Crocker & Paul Jones) TX
Long EZ N91CX (Ray McCrea) CA*
Long EZ N129DD (Don Druckenbrodt) TX
Long EZ N1114 (Darryl Hensingfeld) TX
Long EZ 1N412DM (David Haggard) KS
Long EZ N83DT (David Adams) MO
Long EZ N86DT
Long EZ N49DW (Dan Wicklund) FL
Long EZ N22EM (Ed Madona) OK
Long EZ N27EZ (Jahn Steichen) IL
Long EZ N63EZ (Dan Worley) AR
Long EZ N90EZ (Tim Binder) IA
Long EZ N165EZ (Tom Kranzusch) WI
Long EZ N282EZ (Dan Mislik) MI
Long EZ N321EZ (David Orr) CA*
Long EZ N433EZ (Richard Reuland) AZ

Long EZ N45FC (Ron Cothern) CO
Long EZ C-FRMZ (Roland Moreau) Canada
Long EZ N81LP
Long EZ N6KO
Long EZ N21EM
Long EZ N312SS
Long EZ N81HM
Long EZ N99FW (Fred Wimberly) VA*
Long EZ C-GBVC (S.C. Audet) Canada
Long EZ N197GC (Sam Shelton) GA
Long EZ C-GDOW (Lucas Wagenaar) Canada
Long EZ N20GJ (Gus Sabo) NV*
Long EZ N99HM (Herb Sanders) TN
Long EZ N38JD (Jim Doan) OH
Long EZ N83JM (James Madsen) MN
Long EZ N57JP (James Price) Ml*
Long EZ N731JS (James Napier) CA
Long EZ N818KD (Steve Drybread) CA
Long EZ N28KM (Erik Stolle) NM
Long EZ N58LD (Dave Jones) CA*
Long EZ N776LE (Lew Miller) CA
Long EZ N954LE (Sid Stiber) NY
Long EZ N223MM (Carl Stevens) CA*
Long EZ N407MN (McCumber Nickman Corp.) MN
Long EZ N24ND (Norm Dodge) AZ
Long EZ N510PG (Darryl Nelson) MI
Long EZ N616PH (Pat Halverson) CA
Long EZ N86PT (Gordon Jones) CA
Long EZ N126PW (Harold Peterson) OR
Long EZ N729RA (Rolland Sturtevant) NE
Long EZ N86RG (Ron Gowan) TX
Long EZ N312RH (Stan Sussman) CA*
Long EZ N35RS (Bob Sudderth) WA
Long EZ N424RW (R.G.Westphal) WI
Long EZ N169SH (Dick Rutan) CA
Long EZ N309SH (David Knox) SC
Long EZ N24SK (.Scott Carter) TX
Long EZ N600TD (Dave Dent) CA*
Long EZ N112TG (Buzz Talbot & Robert Gooch) IL
Long EZ NI58TG (Tom Garrison) TX
Long EZ N9TS (Terry Schubert) OH
Long EZ N83TS (Scott Talmadge) FL
Long EZ N200TY (Terry Yake) KS
Long EZ N87WH (George Walters) SC
Long EZ N58WL (Wayne Litherland) MO
Long EZ N30WP (James Jansa) FL
Long EZ N262E (Ralph Galetti) CA*
Long EZ N339E (Jim Evans) VA
Long EZ N4706G (Jim Peck) NM
Long EZ PP-ZAD (Andre Deberdt) BRAZIL*
Long EZ N676H (Maring Fagot) MO
Long EZ N163J (Harry Jenkins) CA
Long EZ N271J (Norm Howell/Jay Greene) CA/AK*
Long EZ N8248L (Steve McCaskie) MO
Long EZ N4372Q (John Stuart) MD*
Long EZ N369R (Bob La Bonte) NH*
Long EZ N715R (Roger Crupper) OH

Long EZ N2398T (Ron Verderame) CA*
Long EZ N3260T (Klaus Savier) CA
Long EZ N7128U (Bob Lemmon) CA
Long EZ N378X (Tom Ridyard) AZ
Long EZ N1378X (David & Robert Iuliano) NY*

Accidents and Incidents

As always, the following reports are published for the sole purpose of helping others to avoid the same problems that caused the accidents.

A VARIEZE crashed in Illinois recently, and unfortunately the pilot was killed. The passenger survived with severe burns.

After this VariEze landed on the 2,300-foot paved landing strip, the two occupants complained that they smelled fuel fumes in the cockpit. They spent considerable effort trying to locate a fuel leak. No leak was found, so they purchased fuel and took off.

At least four eyewitnesses saw the crash. The VariEze reportedly used nearly the entire 2,300-foot runway before breaking ground. It did not climb out of ground effect, and struck the corn in a field off the end of the runway before crashing on the runway centerline a quarter of a mile from where they broke ground.

Witnesses reported that the engine sounded normal, and there was no sign of an in-flight fire.

The VariEze was destroyed, and a fire broke out shortly after impact. The passenger was able to evacuate the aircraft, but received severe burns trying to get the pilot out.

This VariEze was known locally as a "heavy" aircraft, and routinely used lots of runway to take-off. The pilot did not build this aircraft, but purchased it three years previously. He was a proficient pilot, and flew his VariEze often. The pilot was a large man, weighing between 270 and 280 pounds. The weather was clear with temperatures in the high 80's. The pilot's home base runway was 4,000 feet long.

CONCLUSION
This was a heavy example of a VariEze, and had a reputation of needing a long take-off roll. The day was hot (upper 80's) and the pilot was a heavy man. With a load of fuel and a passenger, this aircraft was undoubtedly over gross. Even a lightweight VariEze (630 lbs) would be at the maximum allowable gross weight just with this pilot (270 lbs) and full fuel, not including a passenger! An over gross weight take-off from a 2,300-foot strip on a hot day is simply a recipe for disaster.

A LONG-EZ crashed on take-off in Arizona. The pilot was killed but the passenger survived with serious head injuries.

The aircraft was attempting to take off on a 7,000-foot-long runway with an 1 percent uphill grade. The long-EZ was loaded to more than

150 pounds over the maximum allowable gross weight. The temperature was 85 degrees F, and density altitude was over 8,000 feet.

It was almost dark, 8:30 pm in August 1995, and the tower operator reported that the aircraft initially broke ground at the 4,800-foot mark, but settled back onto the runway. The pilot continued the take-off attempt, lifting off briefly twice more before finally chopping the power and steering around the approach light system.

Unfortunately there was a six-foot chain link fence around the airport perimeter. The Long-EZ crashed into this fence, striking two fence posts, and breaking through the chain link. It crossed a road. broke through a wood-pole fence and came to rest upright on a golf course.

There was no fire, but the chain link fence and/or fence posts severely injured the passenger and fatally injured the pilot.

CONCLUSION
This was yet another example of an attempted take-off at over gross weight! Add to that, a hot, high density evening, plus an uphill runway! This pilot might have been successful with any one of these problems individually, but was unable to overcome them all.

A LONG-EZ crashed near an interstate highway in New Mexico. Weather at the time was bad with low ceilings, poor visibility in rain.

The aircraft struck a tree (a very low tree) and was totally destroyed. Both occupants were killed. Several eyewitnesses reported seeing this aircraft flying very low near the highway.

There was no evidence of any kind of mechanical problem, and it is believed that this accident was caused simply by the pilot attempting to fly VFR in IMC conditions.

CONCLUSION
This particular case is even more difficult to understand since this pilot was very experienced and IFR capable. Was this another case of "get home itis"? Certainly, a 180-degree turn before the weather degraded would have been prudent, and they both may have lived to fly home the next day.

In a tragic accident like this one, it is of course impossible to know what the pilot was thinking, or why he continued in such poor conditions, but having done our share of skud-running, we have had to make many 180-degree turns due to bad weather. So far, we have been lucky, and have made the correct choice. But it is not always easy and many things can cloud your judgment - having to be at work the next day; make a doctor's appointment; deal with a family emergency, etc., - please friends, know your and your aircraft's limitations, and fly within that envelope.

EDITORS COMMENT
The above accidents were preventable and unnecessary. The pilot-in-command is responsible to check the gross weight and to make a "go" or "no go" decision based on the available runway and density altitude. An uphill runway, even an 1 percent grade, is a lot. A 7,000-foot-long

runway. with an 1 percent grade is 70 feet higher at one end than the other.

Think of this as a seven-story building being at the end of the runway. It is hot, it is dark, you are over gross with a high-time Lycoming 0-235 engine. The wind is calm, so no help from the wind (although a downhill take-off should have been an option with no wind). Would you attempt a take-off in these conditions, particularly if you think of the uphill grade as a seven-story building you would have to clear!?

Hopefully not. For most pilots this situation would be unacceptable.

Recently we read in the Cozy newsletter of an attempted over gross weight take-off from a short runway. The take-off attempt was aborted, but the brakes failed to stop the aircraft and it broke through a fence and hit a berm, failing the canard, both wings and the landing gear. Fortunately both occupants survived with minor injuries.

How can accidents such as this be prevented? Know your aircraft's limitations, and know your own limitations. Never try to operate outside of this envelope. Use your common sense. if you don't like the look of a situation, STOP and RE-EVALUATE what you are trying to do. NEVER allow yourself to be driven by schedule - much better late in this world that early in the next!

To report accidents and incidents

Write: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

or Fax: (805) 824-4174
Attention RAF

Reader Mail

Fuel Pump Fire

We recently had an event with our Long that may be of interest to other builders that use Ellison carburetors. We were out in front of our hangar starting our Lycoming 235. After turning on the fuel pump to check its operation I cracked the throttle, primed the engine, fooled around with the primer awhile getting it re-seated, and then hit the starter. The engine did not start immediately and I waited a few seconds then tried again.

The second time the engine back-fired but did not start. Thinking that it was flooded I opened the throttle and was waiting again when I noticed a puff of smoke drift by. This caught my attention immediately!

Fortunately the wind was blowing from behind so I could see the smoke. We were able to extinguish the fire with the use of two big C02 extinguishers but the damage was significant. All the wiring from the firewall (aft) was destroyed, the skin and foam were destroyed around the inlet and the cowling damaged.

Upon investigating the cause it was found that if the fuel pump was turned on and the throttle was advanced any amount above idle cutoff gas would pour from the carb. This had obviously been going on during the starting process and had resulted in fuel gathering in the bottom of the cowl which was then ignited by the backfire.

The carb was returned to Ellison for repair and they determined that some fine dirt and microscopic aluminum particles had gotten under the ball valve which allowed gas to flow even when the engine was not running. They said that a finer filter was required upstream of the carb to prevent this. The carb has a final filter built in but that is not good enough to protect the carb. The built-in filter is rated at 70 microns and there is a 25-micron filter in the Aircraft Spruce catalog that is stated to be approved for the Ellison carb so I guess that the problem is not altogether new even though Ellison seems surprised that we had a fire.

It seems bad practice to put a final filter in a system that is not good enough to protect the downstream components. It has been my practice to start with coarse "rock catchers" and then have increasingly finer filters downstream. The coarse filters then prevent large particles from clogging the finer filters and the final filter protects the system.

To prevent this problem from re-occurring we are installing a drain from the bottom of the aeroduct overboard through the lower cowl. This will not only prevent fuel puddling but it will also let us check for proper operation of the ball check by turning on the fuel pump, advancing the throttle, and looking for fuel from the drain before getting in the airplane.

Once Burned Always Careful,
Owen G. Morris

Sight Gauges
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retro-fit for Long-EZ and VariEze.
$35.00 per set.
Contact: Vance Atkinson
3604 Willomet Ct
Bedford TX 76021-2431
(817) 354-8064

Canopys
Airplane Plastics
8300K Dayton Rd
Fairborn OH 45324
(513) 864-5607

High Density Altitude Takeoffs
Be Aware of Density Altitude

Takeoff in any aircraft on a hot day from an airport located at a high elevation, is not to be taken lightly. You, as Pilot-in-Command,

should always check the density altitude, and most control towers at airports where high density altitude is prevalent will remind you to check "density altitude." This should trigger a mental alarm and you should calculate the density altitude and look up your flight manual takeoff performance estimate. You need this information before you decide to take off.

Flight manual performance data, if accurate, should predict the takeoff capability of a properly flown aircraft. "Properly-flown" is very important as it is possible to greatly extend a takeoff if the pilot does not smoothly fly the correct speeds.

Density altitude is a function of pressure altitude (altimeter set at 29.92) and outside air temperature. For example, at Flagstaff, Arizona (elevation 7,000 feet) on a hot summer day, 100 degree F, the density altitude is over 11,000 feet. This means that your airplane performs just as it would for standard temperature at 11,000 feet!

High altitudes require that you accelerate to higher true speed to attain adequate wing lift. High altitude also reduces the power output of your engine and prop. Also, when your performance is low, a modest uphill runway slope will greatly extend take-off roll. Add all of these factors together and you have an airplane that may roll two or three times as far down the runway before reaching lift-off speed. If you try to rotate early (maybe at about the normal distance down the runway) you will extend the take-off roll even further, due to the drag of the airplane at a high angle of attack, at too low an airspeed. Thus, you will find yourself in a classic "behind the power curve" situation. If you have tried to lift-off at too-low speed you have greatly extended your distance required to clear an obstacle. Your only option is to chop the power and land. Do not wait too late to be able to safely exercise this last option.

As pilots we are all trained about the dangers of heavy, hot, and/or high conditions for takeoff, and how to avoid the "backside" performance problem. Also, your pilot's handbook instructs you to fly faster when heavy or at high density altitude. In general, the EZ pilot community is very familiar with the limitations of their airplanes. However, since these recent accidents occurred, we are compelled to add further emphasis to the pilot's handbooks.

Do not fly until you comply with the plans change section on page 14 of this newsletter.

Request for Proposal
RAF is seeking a vendor to put together an encyclopedia type CD-ROM that provides a reference to essentially all the published information of the Rutan Aircraft Factory. The product must provide a quick user-friendly search capability for text and graphics.

The proposal CD-ROM will include all newsletters with graphics, pilot's manuals and plans for the RAF aircraft.

If your company can help us put this product together-

Fax (805) 824-4174, Attention RAF
for a copy of the

Broken exhaust threatens wing!

This happened to be a Cozy MKIV, but the wing attach system, exhaust system, and engine cowling area are essentially the same as the Long-EZ and Defiant. RAF is publishing the story here in the hope that this knowledge may prevent a similar incident in one of our airplanes.

While flying at 10,000 feet over the Gulf of Mexico near Pensacola at night, the exhaust pipe on cylinder number 4 broke off. Fortunately it remained, in the cowling and did not go through the prop. However, hot exhaust gases traveled between the wing and the center-section spar, heating the epoxy in the wing near the wing-attach hard points. The epoxy softened enough for both wings to move upward at the wingtips, 1/8 inch on the left wing, and 3/8 inch on the right wing.

The spar caps were not damaged, but the shear web on the right wing actually fractured near the out board wing-attach point, allowing the wing to move to a new dihedral angle.

Unfortunately, the pilot was unable to land when he first heard the exhaust let go, but had to fly for nearly an hour to the nearest suitable airport. It is possible that an immediate landing would have prevented the damage and resulting enormous repair job.

The pilot reported that the engine sound made an abrupt change. Performance was not affected, but the noise level was obviously higher, and led him to suspect a broken exhaust system. He throttled back to 1,800 RPM and continued on. He noticed that cylinder head temperatures on 2 and 3 settled down to around 300 degrees F, but cylinder 4 remained up around 400 degrees F.

He landed safely, and had the exhaust stack repaired. He did not notice the wing problem until the next day. There was considerable foam shrinkage (due to heat) all around the hard points. He found a small hole in the inboard glass rib, near the aileron torque tube bearing, and the heat had gotten into the wing through this hole. The only visible damage anywhere in the cowling was a small blister on the cowl itself. Fortunately all of his fuel lines were fire-sleeved, and his wing ribs were protected with 1/8 inch fiberfrax glued on with high-temp silicone. None of the glass on the firewall or in the wing roots were damaged.

What can be learned from this incident? First of all, exhaust systems are subject to vibration and high temperatures and are vulnerable to cracking, even in an type-certificated aircraft.

Inspect your exhaust stacks often and carefully, using a strong flashlight. All visible glass in the cowling area, firewall, center section spar aft face , wing roots, etc, should be protected using fiberfrax. The 1/8 inch-thick material is best, and it should be cut to fit perfectly, and then glued onto the glass using red (high-temp) silicon, available at any auto parts store.

Seal all possible paths for hot air, such as the gap between the center section spar and the wing, and any holes you may have made in the wing root ribs. All of the air, hot or cold, should have to exit the cowl around the spinner in front of the prop, except the air that flows through your oil cooler.

If you ever hear an abrupt, unusual increase in the noise level from your engine compartment, make a precautionary landing at the nearest suitable airport and remove the cowling for a thorough inspection.

Do not fly until you comply with the plans change section on page 15 of this newsletter.

RAF Recommended Suppliers
These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

Aircraft Spruce
PO Box 424
Fullerton CA 92632
(714) 870-7551

Brock Mfg.
11852 Western Ave
Stanton, Ca 90680
(714) 898-4366

Feather Lite
PO Box 781
Boonville CA 95415
(707) 895-2718

Wicks Aircraft
410 Pine Street
Highland IL 62249
(618)654-7447

Prop Manufacturer
600 Superior St
Concrete, WA 98237
(206) 853-8947

For Sale

Ellison Throttle Body EFS-4-5
Suitable for use on a Lycoming 0-360, 180 HP engine. 1,360 hours total time since new, 60 hours since a factory major overhaul. I am upgrading to an airflow performance fuel injection system. $650 or best offer.

Harmonic Damper
Like-new harmonic damper, as advertised in Sport Aviation. It bolts to the starter ring gear, and the manufacturer says it damps out 30-40 percent of engine vibration. It cost over $300. I will sell it for $125.

Fuel Pump
Brand new engine driven mechanical fuel pump (AC type) part number 41271, 4-6 PSI. Cost over $170. Sell for $60.

Solenoid Engine Valves
Two electric solenoid engine primer valves (Skinner) 28V - cost $35 new, sell for $15 each.

Contact: Mike Melvill
24120 Jacaranda Dr. wk: (805) 824-4541
Techachapi CA 93561 hm: (805) 821-1805

MOLDED VORTEX GENERATORS
These pre-molded generators are specially engineered for aircraft application. Available in white, they can also be custom molded in quantity to match specific paint colors for aircraft manufacturers and OEM suppliers. After installation, the sail appears to be molded an integral part, rather than and "add-on". The final result not only looks better, it performs better than typical hand-made aluminum fences. Molded vortex generators adhere better, do not corrode, require no painting and are easy to install: one Long-EZ canard can be equipped with a full span of generators in less than 90 minutes.

A kit containing fifty generators is available for a price of $25.00 plus $2.00 shipping and handling per kit. Two kits are sufficient to equip the full span of a typical canard (i.e. Long-EZ, Dragon-Fly, et al) or both ailerons on either canard or conventional planforms. Documentation is included. Please send check or money order to:

CCI, PO Box 607,
Plainfield, NJ 07061-2318
Please allow 2-3 weeks for delivery, Sorry, no COD'S.
For more information 6:00-10:00 pm EST, Mon.-Fri.
(908) 757-9573
(908) 755-9639 FAX
Note: These vortex generators are not TSO'd for use on type certificated aircraft.

F-16 DEEP STALL INCIDENT VIDEO
Gives a pilots-eye view of a deep stall which almost doesn't recover. Includes a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall, as well as a transcript of the audio portion (for clarity). Price $13.00
Contact: Charlie Precourt
7051 Little Redwood Dr
Pasadena TX 77505-4433

NOSE WHEEL SHIMMY DAMPER
Bob Davenport tells us that he can still supply this excellent damper. Unfortunately he gets very few orders now a days but can sell them even if he gets only one order. Including the set up charge, the cost is $236.00 delivered in the USA.

Contact: Bob Davenport
P O Box 650581
Vero Beach FL 32965-0581
(407) 567-1844

FLUSH, INTERNALLY MOUNTED ANTENNAS
A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum

performance and in general those who have used them so far report reception is doubled over standard external antennas.

VariEze builder/flyer Bill Butters has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of coax cable to facilitate easy installation with minimum weight and bulk.

Call: Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant MO 63032
1-800-758-8632

NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.

Curtis Smith
1846 Sextant Dr.
Worden IL 62097
(618)656-5120

TITANIUM ACCESSORIES AVAILABLE!
Custom anodized to any of 15 different colors, shades of copper, purples, blues, greens, yellow/gold, even rainbow effect. Rudder and aileron gustlocks - $20.00-$30.00.

GU canard full span vortex generators with layout template - $170.00.. These are very exciting! Rudder horn CS-301L&R replacements, $25/pair. Shipping inc.

Ti Specialties
P O Box 1052
Grover Beach CA 93483-1052
(805) 489-8155

Feather Lite
LONG-EZ PARTS PRICE LIST

Main gear strut	$349.00
Nose gear strut	$58.00
Engine cowls, pr. (Glass)	$329.00
Engine cowls, pr. (Kevlar)	$480.00
Cowl inlet	$48.00
Wheel pants (3.5x5)	$150.00
Wheel pants (500x5)	$180.00
Above item in Kevlar	$215.00
NG 30 cover	$21.00
Pre-cut canard cores	$160.00
Pre-cut wing & winglets	$1199.00

Leading edge fuel strakes w/bulkheads	$524.00
Strut cover SC	$19.50
Nose wheel cover NB	$19.50
Sump blister	$19.50
NACA inlet	$47.00
3" extended nose gear	$70.00

Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00
Contact: Michael Dilley or Larry Lombard
(both former RAF employees and EZ builders and flyers)
Feather Lite, Inc.,
PO Box 781
Boonville CA 95415
(707)-895-2718

Feather Lite bought Bruce's equipment from B&T PROPS and will soon make an announcement as to when they expect to begin producing props.

Christmas Shopping

Posters

Chronological lith poster	(see cover CP64)	$10.00
Jim Sugar night poster	(Voyager & Friend)	4.00
Defiant on water.		4.00
EZ 3-ship 17x22	(see cover CP 62)	4.00
Long-EZs in trail (llxl7)		4.00
Color photos (8x 10)		2.00

Stocking stuffers

Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	3.00

Video

Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00

Sensible stuff

VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	9.00
Defiant owner's manual	15.00
Large rudder plans	18.50
Speed brake	10.00
0-235 engine installation	21.50
Roncz Canard	42.50
Flush belhorns	10.00
Moldless Composites manual	14.50

Postage & handling included in price.

Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

STARTER FOR 0-200 CONTINENTALS
B&C Specialty has introduced a beautifully made, 12 volt starter specifically designed to be installed into the accessory housing on a Continental 0-200 engine, or on an 0-240.

This starter has been thoroughly tested at Teledyne Continental (more than 5,000 start cycles without a single problem!).

Bill Bainbridge has these starters available for immediate delivery and they can be had STC'd or for homebuilts.

Contact: B&C Specialty Products, Inc.
123 East 4th Street
Newton KS 67114
(316) 283-8662

Plans Changes

Do not fly until you comply with the following plans change.

MANDATORY GROUND for All RAF DESIGNS until adding the following information to the takeoff performance section of your pilot's handbook:

High Density Altitude Takeoffs
The combination of high aircraft gross weight and high density altitude represent significant dangers for takeoff obstacle clearance. Special care is required to avoid premature rotation, ie, if liftoff is too slow, the aircraft will be on the back side of the power curve and may not climb.

When operating heavy and high (say, within 100 lbs of gross weight and above 5,000 ft density altitude) do not fully rotate to liftoff attitude until your airspeed is within 5 knots of the best rate of climb speed, for your specific weight and altitude (see climb charts). This will require more runway than a slower liftoff, but will assure the best capability to clear obstacles and continue a safe climb. Never attempt takeoff under conditions in which you cannot achieve best rate of climb speed while still on the available runway. If this ability is not clear at any point during takeoff - abort. Off-load weight or wait for a cooler time of day.

Lift-off is possible as slow as the "minimum lift-off speed," and can be successfully used at light weights and/or low altitudes to achieve a short ground roll. However, that technique will usually result in inadequate initial climb if used when heavy or high.

Runway slope effects are minor when light or at low altitudes, but they become very significant when heavy/high. For example, a 1 percent uphill runway slope may add well over 1000 feet to the distance required to clear an obstacle. Never takeoff uphill when your takeoff

roll performance is marginal. Never continue a takeoff if crosswinds require you to brake so much that a safe liftoff is in doubt. Always use "best power mixture" for high attitude takeoff conditions. An over-gross weight takeoff that seems like an acceptable operation near sea level can be a real killer when hot and high. Never attempt a takeoff when over approved gross weight.

There may be considerable variance in takeoff capabilities from one homebuilt aircraft to another of the same type. Engine installed power and propeller efficiency at low speeds may be less than that for the prototype that provided the basis for the takeoff distance charts. Find a long runway and measure your takeoff capability at the weights you intend to fly. If your actual performance is less than the charts, correct the charts or improve your prop and/or engine.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may discover as you go through the building process.

Plans Changes

Do not fly until you comply with the following plans change.

MANDATORY GROUND for All RAF DESIGNS until the following changes are made on your aircraft -

All RAF designs
Check Fuel Pump

Fuel draining out of the carburetor, as reported by Owen Morris (see Reader Mail on page 9), be it a Marvel Schebler, an Ellison, or a Bendix fuel injection system is a potential catastrophic fire hazard! It is very important to create a small drain hole at the low point in the induction hose. Fuel must be able to drain into the cowling, and you must drill a hole in the low point of the cowling, so that this fuel can drain on out of the cowl.

The fuel comes from priming the engine, prior to and during the start cycle. The worst offender is the carburetor with a throttle pump installed. Some pilots pump these throttles several times just before cranking with the starter. The throttle pump squirts a fine mist of raw fuel up into the intake manifold, but most of the fuel runs back out of the carb, and if the engine backfires during the start sequence you have a fire. Even manually-primed and injected engines can and do have raw fuel drain down the intake manifold tubes and out of the carb or throttle body. You as the aircraft manufacturer are responsible to provide a path for this fuel to get out of the manifold/throttle body/air filter/inlet hose/whatever, and out of the cowling onto the ramp.

This problem only occurs while starting and normally is not an in flight problem. Check your aircraft and if this has not been taken care of, fix it before your next flight.

VariEze, Long-EZ, Defiant
Inspect & Comply
Inspect and comply with the additional sealing and heat insulating areas on the rear engine installation as described on page 11.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may discover as you go through the building process.

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Pilots in France celebrated the 20th anniversary of the VariEze along with their U.S.A. cousins. Their Montpellier fly-in drew 42 composite aircraft, including 37 canard types. **PHOTOGRAPH OMITTED**

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