REGISTRATION NUMBER N ____________________

BUILT BY ____________________

ADDRESS ____________________

____

DATE OF MANUFACTURE ____________________

ENGINE MANUFACTURE TYPE ____________________

SERIAL NUMBER ____________________

TOTAL/SMOH HOURS AT INSTALLATION ____________________

DATE OF FIRST FLIGHT ____________________

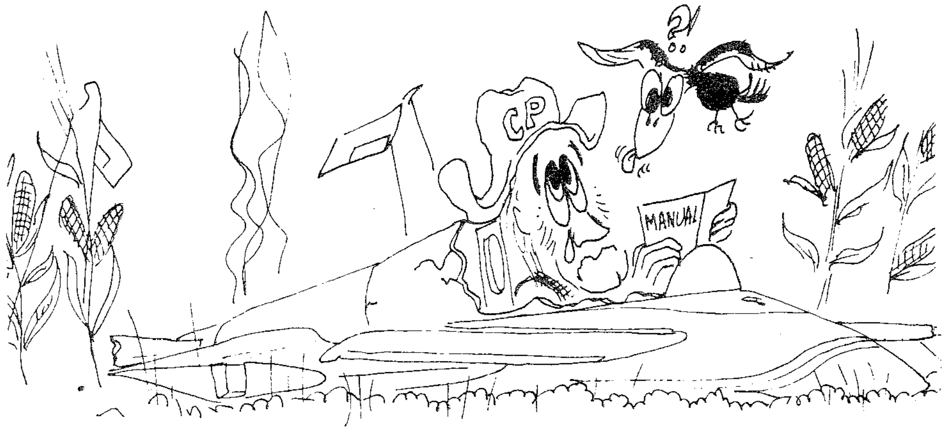
SOLD TO ____________________

ADDRESS ____________________

____

DATE SOLD ____________________

NOTES ____________________



CONTENTS

NOTE

THE INFORMATION IN THIS MANUAL REFERS TO AIRCRAFT BUILT ACCORDING TO THE LONG-EZ MANUFACTURING MANUAL. ANY HOMEBUILDER MODIFICATIONS MAY ALTER THE APPLICABILITY TO YOUR AIRCRAFT.

WARNING

THIS MANUAL IS OBSOLETE UNLESS UPDATED BY NEWSLETTER #30 AND ON.

GENERAL DESCRIPTION

The Long-EZ is a modern, high performance custom built, long range aircraft featuring the latest advances in aerodynamics and structure to provide good utility, economy, comfort, simplicity and flight safety. The aircraft uses one of two proven certified aircraft engines, the Continental 0-200 (100 hp), and the Lycoming 0-235 (115hp). 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, accessable from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

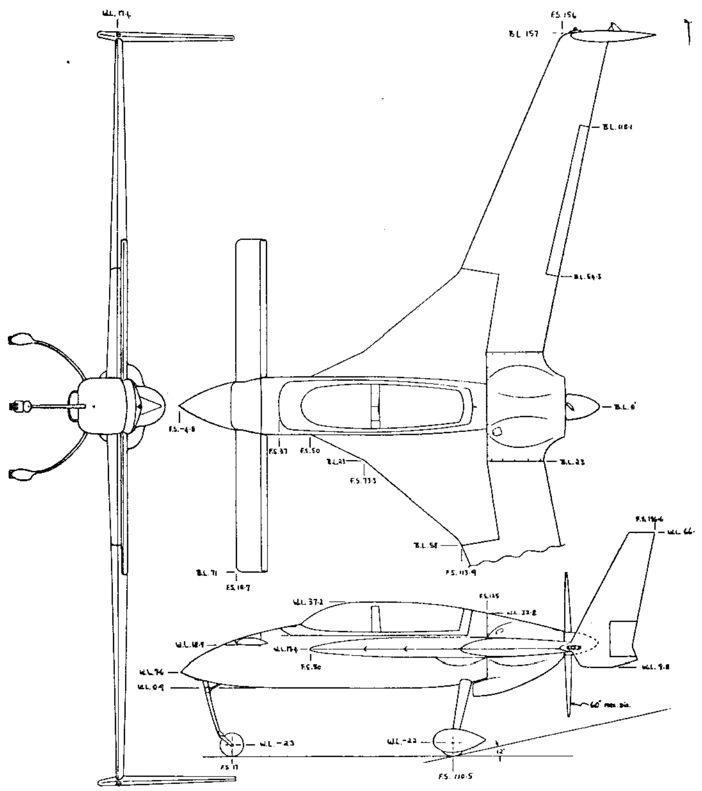
The Long-EZ aircraft pioneers the use of the NASA-developed winglet system, which consists of an upper and lower cambered surface at each wing tip. These are designed to offset the wingtip vortex and reduce induced drag. The Long-EZ's use of one-way rudders in each winglet makes use of the winglet camber to tailor the rudder forces. This results in low forces at low speeds where rudders are used, and higher forces at higher speeds where rudders are not needed.

NOTE

The Long-EZ is not suitable/recommended for operations from unprepared surfaces: gravel, loose dirt or rough fields.

DIMENSIONS

Wing Span/Area	26.1 ft	(7.9m)	81.99 ft^2	(7.62m^2)
Canard Span/Area	11.8 ft	(3.6m)	12.8 ft^2	(1.19m^2)
Total Wing Area	94.8 ft^2	(8.81m^2)		
Length	201.4 in	(5.12m)		
Height	94.5 in	(2.4m)		
Cockpit Width				
Front	23 in	(0.58m)		
Rear	21 in	(0.53m)		
Cockpit Height				
Front	36 in	(.91m)		
Rear	35 in	(.89m)		
Cockpit Length				
Front	70 in	(1.78m)		
Rear	54 in	(1.37m)		



WEIGHTS

The normal equipped empty weight is approximately 750 lbs. Actual weights for each airplane will vary, according to installed equipment and builder workmanship. The maximum allowable gross weight for takeoff is 1325 lbs. except as noted below. The strake baggage areas are structurally limited to 100 lbs each side. The airplane can structurally accomodate pilots or passengers weighing up to 250 lbs. Actual limitations of each pilot area, each baggage area and fuel load depends on the empty weight and balance of the particular aircraft. Nose ballast may be required for light pilots, particularily for starter-equipped aircraft. See weight and balance section, page 27.

NOTE

A gross weight of up to 1425 lbs can be allowed for takeoff but only under certain conditions. See weight and balance section of this manual.

ENGINE AND PROPELLER

The Lycoming O-235 and the Continental O-200 engines are currently approved for use in the Long-EZ. The standard accessories: alternator, starter and vacuum pump, maybe used. The Lycoming O-235, 100 octane dynafocal mount, is the most desirable engine. Both the Lycoming and Continental are suitable for pusher operations in this application. Both engines are currently in new production. However, the used/rebuilt engines are approximately one half the cost of a new one. A partially run-out engine is generally perferred, due to the excessive cost of a zero-time engine. The Continental O-200 is being built in Europe and marketed in the U.S. under the "Rolls-Royce Continental" name.

Due to weight/balance and structural considerations, heavier or higher horsepower engines are not recommended. The Rolls O-240 (130 hp) and Lycoming O-235-F (125 hp) engines will probably be satisfactory, since they meet the weight restrictions, however they have not been flight tested on a Long-EZ.

Only the light-weight fixed-pitch solid wood propellors are approved. Turbo charging and constant speed, variable pitch or metal propellors are not recommended. Extensive development/testing would be required to qualify a metal or variable pitch prop for pusher application due to aerodynamic-induced vibration.

The modern wood prop uses a plastic leading edge to minimize rain erosion and has an efficiency close to the best metal prop, while offering a solution to the fatigue problem. Climb and cruise props are listed below. Note that the climb prop does not limit maximum speed. Max speed **is** fastest with the climb prop, but the engine turns faster than rated RPM at max speed.

Prop	Engine	Prop Dia & Pitch	Prop Efficiency Cruise	Prop Efficiency 80 Kts.
Cruise	O-200	58 - 70	84 %	52 %
Climb	O-200	58 - 64	84 %	60 %
Cruise	O-235	58 - 72	84 %	52 %
Climb	O-235	58 - 66	84 %	60 %

We prefer the "climb" prop, to obtain the best takeoff performance. Cruise at 60% power is at about 95% of rated RPM - our most used cruise condition. Cruise at 75% power (max cruise) results in a RPM of 100 to 200 over the engines rated RPM. With these light wood props this overspeed condition is not detrimental to the engine when operating at less than 75% power (above 8000 ft., full throttle). The overspeed at max cruise can be eliminated by selecting a "cruise" prop, however takeoff performance and climb is effected as much as 25%.

NOTE

All the above sizes are for prop manufacturers who use the "flat bottom" as a pitch reference, which results in some "negative slip". If your prop manufacturer used the "zero lift line" as a pitch refernce, add about six inches to the above pitch values. Some variance in pitch occurrs occurs with different manufacturers, to obtain the same prop load. Check with them before ordering.

LANDING GEAR

The Long-EZ features a tricycle landing gear with fixed mains and a retractable nose wheel. The main landing gear is a one piece, molded S-fiberglass/epoxy unit which gives exceptional energy absorption for bounce-free landing. For minimum drag penalty with fixed main gear, the gear strut is molded into an airfoil shape, eliminating the need for superficial fairings. The main wheels can be streamlined with wheel pants. The retractable nosegear strut is also molded S-glass, and is mechanically actuated by a simple crank in the front cockpit. The nose gear is retracted in flight for optimum performance and also on the ground to provide nose-down parking. This stable, self-chocking parking position allows easy entry for the backseat passenger. Nosegear position is displayed to the pilot through a plexiglass window, through which he views the nose wheel directly.

The main landing gear uses Cleveland 5-inch wheels and brakes. A low-profile 3.40 x 5 industrial rib 6 ply tire is used. Larger 500 x 5 tires can also be used on the mains. The nose wheel is 4-inch diameter and uses a 2.80-2.50-4 tire and tube.

The Long-EZ is equipped with a buzzer gear-warning system which is actuated at low power settings with the gear up.

COCKPIT

Both front and rear cockpits are exceptionally comfortable. Semi-supine (reclined) seating is provided for optimum crew comfort. Pilots up to 6 feet 6 inches tall and 220 lbs, and passengers up to 6 feet 3 inches tall and 220 lbs will find the cockpit quite comfortable. Pilots 6 foot 3 inches or less, find it easy to seat themselves first and then comfortably extend their legs forward from the sitting position. The canard configuration provides a wide cg range which allows for a full-length rear cockpit without the passenger having to straddle the pilot.

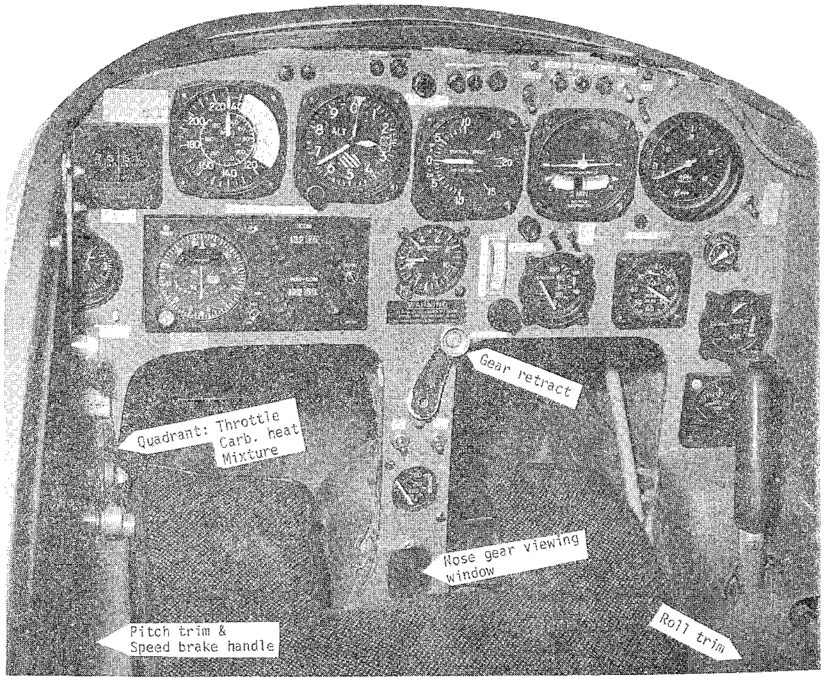
Full flight controls are provided in the front cockpit only. The wrist-action control stick is positioned on the right side console, enabling the pilot to relax and rest the weight of his arm on the side console, reducing his work load on long trips. Throttle, carburetor heat and mixture controls are found on the left side console. The landing-gear crank actuation knob is found in the center of the instrument panel.

A control stick is located in the rear seat area to allow a rear seater to land if the pilot becomes incapacitated. The rear stick is removable to allow increased baggage room. The rear seat does not have rudder pedals, due to the awkward foot position of the rear seat occupant. Also, the airplane is not intended for, nor recommended for flight training,

The inboard portion of the large wing strakes are used as baggage areas, accessable from the front and rear cockpits. Small baggage, snacks, maps and navigation instruments may be stored in the front cockpit in two areas beneath the thigh support and in the pilot headrest/map case/roll over structure. Two custom-made suitcases fit into the rear cockpit behind the pilot's seat against each fuselage side. The two suitcases still allow full-length leg room in the rear cockpit. Baggage areas inside the center-section spar and behind the rear seat provide additional stowage.

Due to the highly insulated fuselage structure and long plexiglass canopy, the Long-EZ will maintain about 60° F inside temperature with an outside temperature of 10°F (vent closed, sun shining). Thus the requirement for cabin heat is far less than conventional light-planes. Due to the small cabin volume and good vent location the EZ is more comfortable on hot days than conventional lightplanes.

The airplane is equipped with an electrical buzzer which warns the pilot not to take off with the canopy unlocked. Also, a canopy safety latch is installed as a back-up, to catch the canopy if the pilot forgets to lock it for takeoff.



FUEL SYSTEM

The fuel system consists of two 26 gal. individually selectable wing tanks. A three way selector left, right, off is located on the thigh support center just aft of the nose wheel position window. There is no provision for cross feed nor can fuel be used from both tanks simultaneously. Two fuel sump blisters located under each fuel tank at the fuselage junction assure fuel supply to the engine in all normal flight attitudes. Each tank is individually vented. Vent location is on the center fuselage just aft of the canopy. A mechanical engine-driven fuel pump transfers fuel from the tanks to the carburetor. An auxillary electric fuel pump provides backup for the engine-driven pump. Fuel pressure is indicated on a gauge in the cockpit. The electric pump should be turned on if the engine-driven pump fails as noted by a loss of fuel pressure. The electric fuel pump should also be used to provide fuel pressure redundancy during low altitude operation, such as takeoff and landing.

There are three fuel drains on the airplane, one in the leading edge of each fuel tank strake and one on the gascalator mounted on the fire wall. The gascalator is easily accessable through the air scoop under the cowling for draining during preflight. To prevent over-filling the fuel tanks, exceeding the gross weight limitations for two place, the tanks can not be completely filled with nose down parking. To fill the tanks to the full 52 gallon capacity the nose wheel must be extended to level the aircraft. Be carefull to hold the nose down during this operation. The nose can be lowered after full up fueling with the caps on without leaking. However, heat expansion may force fuel out the vents. Filling to the full capacity should be done only when required for single-place extended-range trips.

CAUTION

Fuel additives should be checked for compatability prior to use. Some fuel additives such as MEK or deicing fluids like "Canned Heat", auto gas, especially the high aeromatic content no-lead, should never be used. They can desolve the epoxy in the fuel tanks.

CONTROL SYSTEM

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. The cockpit controls are similar to most aircraft with pitch and roll controlled by the side stick and two rudder pedals for yaw. The side stick controller is employed to give the pilot the smallest workload control arrangement possible. The rudders, located on the winglets at the wing tips, operate outboard only, providing two totally independent systems. The rudders are used singly for yaw control or can be deployed together as a mild speed brake.

BRAKE

Brakes are provided on the main wheels. They are used together for deceleration on the ground and individually for directional control at low speed on the ground. The brake actuating mechanism is the rudder pedal: after full rudder deflection is reached, the brakes are actuated. The brake master cylinder is the rudder stop. This system aids in keeping brake maintenance low by insuring that full aerodynamic control or braking is employed before wheel brakes are applied.

The parking brake is provided by the rubber bumper on the nose gear (nose down parking). For those aircraft not equipped with a starter there is a brief period, after the engine is hand prop started, while the pilot enters the cockpit that the aircraft could roll forward before he can get his feet on the brakes. Avoid parking downhill or downwind to keep the airplane from rolling. One solution is to use a small wheel chock on a tether that the pilot can pull in after reaching the brakes.

TRIM SYSTEMS

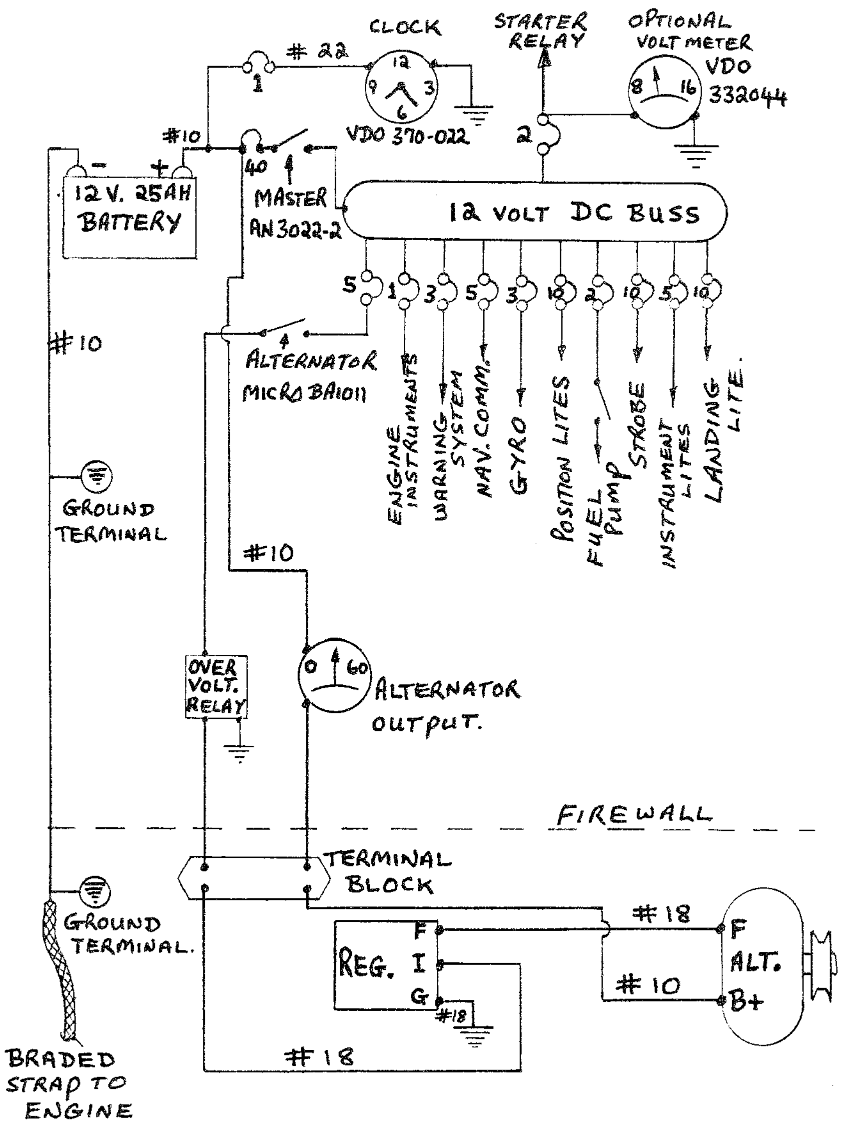
Cockpit-adjustable trim is provided for pitch and roll only. Yaw/rudder trim is ground adjustable only. Pitch and roll trim are bungee/spring systems. Adjustable aerodynamic trim tabs are not used. The pitch trim handle is located on the left console inboard of the landing airbrake handle. The aileron trim handle is located on the right console. The pilot can safely override any trim setting even if it's stuck in an extreme position. The pitch trim can trim to hands-off flight from stall to maximum speed. This feature allows the pilot to land the aircraft using the pitch trim, rudders, and throttle only. This is an excellent backup should a failure/disconnect occur in the normal control stick.

LANDING AIRBRAKE

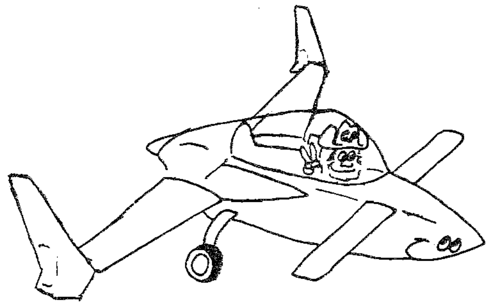
A drag device is used to allow a steeper approach and to provide more deceleration in the flare. This belly-mounted "speed-brake" is deployed by a lever on the left console. It is normally extended on downwind after gear extension and left down until after landing. Maximum speed with the airbrake down is 90 knots (105mph). Above 95 knots (110 mph) the brake automatically closes. The brake does not affect trim, stability, stall speed or stall characteristics. The awkward position of the brake handle in the deployed position aids in reminding the pilot that the brake is down if he forgets it on his takeoff checklist. Climbs should be avoided with brake down, as cooling and climb rate are reduced. The brake induces a mild buffet when down. During landing and taxi the landing brake down provides some prop protection from rocks being kicked up by the nose wheel.

ELECTRICAL SYSTEMS

Refer to the adjacent diagram that shows the basic electrical power distribution. Note: Any builder modifications should be noted on this diagram. Fill out the installed electrical equipment.



Alternator system shown. For generator or solar systems, revise this page as required.



NORMAL OPERATIONS

This section covers the normal operating procedures for the Long-EZ. A summary checklist is provided at the end of this book for more convenient cockpit use. Detailed loading information and performance data are provided in later sections of this manual.

PILOT POSITION

The Long-EZ was designed to accomodate tall pilots up to 6 ft . 8 in. Short pilots can fly the aircraft but they must sit on cushions to position their eyes in about the same position as tall pilots in order to have adequate forward visibility. The adjustable rudder pedals should be set in the aft position for short pilots and they should use cushions primarily under them, not behind them. If a short pilot uses a large cushion behind him, he will be positioned forward and down because of windshield slant angle and have inadequate forward visiblity during climb and landing flare. Confirm that your head is within 1" of touching the canopy before you take-off.

ENGINE START

Engine starting maybe accomplished by hand-propping. While you have doubtlessly been horrified by the accident statistics on hand-starting antique aircraft, remember that the Long-EZ is a totally different story. Antiques are generally tractor aircraft, which means that they tend to chase you, once started. Long-EZ's on the other hand, try to run away from you. The traditional hand-start airplane has to be chained down and main wheels blocked for marginal safety (the tractor prop still tries to suck you in). The Long-EZ with nose-down parking, chocks itself, and the pusher prop blows you away from danger. With modern, impluse-coupled magnetos, it is not necessary (or desirable) to make a Hurculean pull of the propeller for starting; just pull the engine up on compression and give it an EZ flip through. In the unlikely event that your Long-EZ does run away from you after starting (if you leave the throttle open), it won't carve the first thing it comes to into hamburger, but will give it a bump with the nose instead. Note also that on a tractor installation, you have to reach through to the back of the prop to grab it. On a pusher, you hold the prop on the face nearest you. For engine starting the aircraft should be parked nose down on the bumper.

Be sure your carburator has an accelerator pump for automatic priming. Starting can be diffucult without one. Even though the Long-EZ is much less susceptible to runaway during hand propping, it is still a good practice to have someone tend the throttle and switches during starting. Some engines have only one magneto eqippped with an impluse. Be sure the non-impluse magneto is off for starting. If your Long-EZ is starter equipped, use special care that the prop is clear before starting. Holler loud and wait for a response or time for the person to get out of the way. Have an outside observer confirm the prop is clear prior to starting.

COLD START

- Pump throttle once or twice
- Mags OFF
- Pull engine through four blades
- Mag/s ON
- Grab prop about 1 ft from tip; pull down onto compression, and give prop a smooth flip.
- Repeat as necessary. If the engine does'nt start after five or six pulls, see flooded start procedure or very cold conditions procedure.

HOT START

- Leave throttle at idle (don't pump).
- Mag/s ON
- Pull prop through gently
- If the engine gives no indication of starting after three or four tries, use flooded start procedure.

FLOODED START

- Mags OFF
- Throttle OPEN or 1/2 open.
- Turn prop BACKWARDS about 10 blades to clear manifold.
- Throttle - 1/2 inch from closed.
- Mag/s ON
- A flooded engine will start easier if cranked with throttle about 1/2 open. Do this only if you have someone standing by with his hand on the throttle to retard it to idle immediately when the engine starts running.

VERY COLD CONDITIONS

- Very cold temperatures, below 25° F, will make engine hard to start.
- Pump throttle four times
- Mags OFF
- Pull prop through four blades
- Mags ON
- Pull prop through gently
- When feasible, engine preheat or use of an oil dipstick heater is desirable.

After start, the engine should be idled at 1000 RPM. Oil pressure should rise to within limits within 30 seconds.

TAXIING

Have your passenger board and strap in while the aircraft's nose is still on the ground. Long-legged types may step directly into the rear cockpit. Shorter passengers can step into the front seat first, then into the rear cockpit. With your passenger aboard, raise the nose by lifting at the canard leading edge. Crank the nose gear into the extended position and enter the cockpit by swinging your leg over the side or using the step. Do not try to raise or lower the nose with the nosewheel crank, with any weight on the gear.

> **CAUTION**
>
> Keep taxi speed slow on unprepared loose surfaces. The Long-EZ is more susceptible to prop damage than a conventional aircraft.

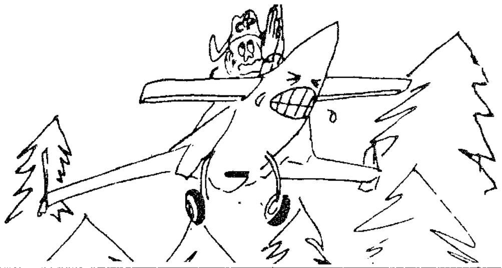
Steering below 25 knots (30 mph) is accomplised by applying full rudder and brake as required in the direction you wish to go. As you accelerate, the single pedal control will automatically shift you to rudder steering as the rudders become increasingly effective. The nose gear will free swivel, enabling you to maneuver in very tight places with ease. At low speed, steering is done exclusively with differential braking. The geometry of you Long-EZ makes it much less sensitive to upset than most aircraft; comfortable taxiing operations have been demonstrated in 40 knot crosswind components. Be carefull to hold the stick while taxiing downwind so the "tailwind" won't damage the ailerons/elevator.

> **CAUTION**
>
> When taxiing with the canopy open, be careful that the wind doesn't slam it closed on your fingers! Close and lock the canopy during windy conditions.

TAKEOFF

Complete your pretakeoff checklist. Check static RPM at full throttle. It must be at least 2450 for normal takeoff performance. Double-check that your canopy is locked down. Taxi forward a few feet to straighten the nose gear. Set pitch trim for takeoff.

NORMAL: Apply full throttle smoothly. As the aircraft accelerates, use rudder and brake as necessary for directional control. Maintain slight aft stick pressure as you accelerate to relieve the nose wheel. Rotate the nose gear just clear of the ground as soon as possible about 50 - 60 knots (59 - 70 mph) and hold the nose wheel just clear as you accelerate to about 63 knots (72 mph). As you pass through 63 -65 knots (72 - 75 mph) rotate smoothly and you'll be off and flying. Add 5 knots if operating at heavy gross weight.



CAUTION

Never rotate the nose beyond the angle that places the canard on the horizon.

CROSSWIND TAKEOFF

During takeoff ground roll, with a crosswind component above 10 knots you will find that wheel braking maybe required long into the ground roll for directional control. In stronger crosswinds you may require braking right up to rotation speed for directional control. The best technique is to hold full rudder but not to ride the brake continously. Apply brake intermittenly and allow the aircraft to accelerate between applications. The takeoff ground roll can be extended significantly (50% or more) by strong crosswind, especially at high gross weights and high density altitudes. The braking requirement for directional control is the reason for the takeoff limitation of 15 knots crosswind. Landings can be made up to a 20-knot crosswind component. Crosswind takeoff technique: Hold aileron into the wind as you rotate for lift off. Let the aircraft accelerate above normal rotation speed and then rotate the nose abruptly to make a clean lift off without side-skip. For crosswind components above 10 knots add 5 knots plus one half the gust factor to the normal rotation speed. When clear of the ground make a coordinated turn into the wind to correct for drift.

SHORT FIELD OBSTACLE CLEARANCE

Reduce gross weight as much as feasible and check the cg to insure it is not so far forward as to delay rotation. Be sure the engine is thoroughly warmed up and taxi to the very end of the runway. Align the aircraft with the runway, hold the brakes and apply full power. Release brakes and try to use minimum braking for directional control. Rotate to lift-off at 56 knots (light weight) or 65 knots (heavy weight). Maintain 70 knots (80 mph) best angle of climb speed, until the obstacle is cleared, then accelerate to normal climb speed. See page 53 for distances.

ROUGH FIELD CAUTION

Although the Long-EZ may use the larger 500 x 5 tires this does not make the aircraft totally suitable for rough, gravel or unprepared fields. Since the Long-EZ is a pusher the aircraft cannot be rotated as easily as a conventional tractor aircraft. You still must accelerate to normal rotation speed 50 - 60 knots, depending on cg, before the nose wheel comes off and during this time the nose wheel can kick debris into the prop. The small nose wheel tire, high rotation speed and prop damage possibility makes the Long-EZ less suitable for unprepared field operation than a conventional a aircraft.

However, if you must use an unprepared surface, reduce gross weight as much as feasible and adjust the cg as far aft as practical (within limits) to allow an early rotation. Do not use high power with the aircraft stationary, do the mag check on the roll if necessary. Hold full aft stick and apply power gradually to start the aircraft rolling before coming in with full power. This technique will help minimize prop damage. As the nose raises, the elevator should be eased forward so the nose wheel is held just clear of the ground. Accelerate and lift-off at the normal speed and accelerate to the desired climb speed. Don't try to "jerk" the aircraft off prematurely, this only places the prop closer to the ground and increases the chance of damage.

NOTE

Rutan Aircraft Factory has developed a spring-loaded shock strut for the nose gear. This unit permits the nose wheel strut to deflect farther aft and up. This shock strut along with the larger 500 x 5 main gear tires will provide satisfactory operation from most grass fields and will allow operation from rough fields. However, because of possible prop damage, avoid gravel or fields with loose rocks.

HIGH DENSITY ALTITUDE

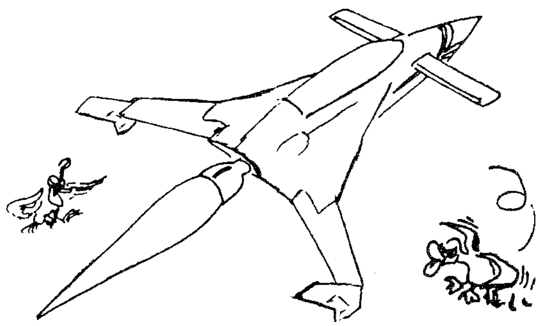
At density altitudes above 5000 ft, follow the normal takoff procedures and (1) lean the engine for best power during run up (2) let the aircraft accelerate to 65 -70 knots (75 - 80 mph), then smoothly rotate and lift off.

CLIMB

Climb performance data is given on page 54 of this manual. For optimum rate of climb, maintain 90 knots (105 mph). Best angle of climb is obtained at 70 knots (80 mph). For better visibility and improved cooling, a normal cruise climb of 110 knots (125 mph) is used. Climb performance is improved with the nose gear retracted, although not drastically and it should be retracted once your initial climb is established.

NOTE

A standard non-turbocharged Long-EZ (N79RA) attained an altitude of 26,900 ft in December '79.



CAUTION

The altitude capability of this aircraft far exceeds the physiological capability of the pilot. Use oxygen above 12,500 ft.

CRUISE

Maximum recommended cruise power setting is 75%. A high cruise power setting (full throttle at 8000 ft density altitude), will result in the maximum true cruise speed of 161 knots (185 mph) for Lycoming and 149 knots (171 mph) for Continental. However, to take the best advantage of range and fuel economy, you may find that cruise power settings as low as 45% get you to your destination faster by avoiding fuel stops. Cruise at 60% power is the best compromise, providing good speeds and significant lowering of engine noise over 75% power. Lean your fuel mixture for best economy at cruise. Below 75% power (65% for Continental) lean mixture until a very slight RPM loss is noted (20 RPM max). This approximates peak EGT setting for optimum lean mixture. Note (page 58) that best range is obtained at a very low speed.

A good thumb rule for choosing an economical cruise power setting, is to cruise at the same RPM that you get during a full-throttle static run-up before takeoff.

Maneuvering speed is 120 knots (140 mph) indicated - remain below this speed in rough air.

Check the fuel level in each tank occasionally. Switch tanks to maintain a reasonably balanced fuel load. If possible, select an unused tank only when a forced landing can be easily accomplished (in case the valve malfunctions or there is water in the newly selected tank). Always try to be within range of a suitable landing place with the fuel in the selected tank until you verify that you can select and use the other tank.

Once at cruise altitude in smooth air, trim the aircraft to allow hands-off cruise. It is much less fatigueing to fly by using an occasional shift of the body weight or an occasional small adjustment of the trim knobs, than to fly by continously holding the stick. After a little practice setting trims, you will find you will be doing most of your flying including climb and descent without holding the stick. The rudder pedals are designed to allow the taller pilot to tilt his feet inward and relax them in a stretched-out position in front of the rudder pedals. This places the weight of the thigh on the thigh support, rather than the tail bone and greatly increases comfort on long flights.

The Continental engines are particularly susceptible to carburator ice. Icing can occur during cruise in moist air, particularly at low cruise power settings, When in moist conditions, check carburator heat often or cruise with heat on.

CAUTION

When entering visible moisture (rain) the Long-EZ may experience a pitch trim change. The Long-EZ prototype (N79RA) has a significant nose down pitch trim change in rain. The VariEze prototype has a mild nose up trim change. Some VariEze owners report nose up and some nose down. This phenomenon is not fully understood and your aircraft may react differently. Our flight test on the prototype Long-EZ have found a slight performance loss and the pitch trim change forces could be trimmed hands off with the cockpit trim handle at air speeds above 90 knots, when entering rain. Once the aircraft is in visable moisture conditions it can be retrimed and flown normally. There maybe a disorientation factor during the transition from VMC to IMC that the pilot must be ready for, especially if your trim change is significant. If your rain trim change is found to be significant, install a placard to notify pilots of this characteristic.

DESCENT

You will find that your Long-EZ has such good climb performance that you routinely use higher cruising altitudes to avoid turbulence discomfort more often than with most light aircraft. It is not unusual nor inefficient to climb to 12000 ft altitude for a 150 mile trip. Bearing this in mind, you want to plan your descent into your destination enough in advance so that you don't find yourself over your destination with 10,000 ft of altitude. The Long-EZ is a clean airplane and even with power at idle it may take 20 minutes to land! Using the extra altitude for a cruise descent speed advantage will get you there a lot sooner. Don't forget to reduce power slowly to avoid rapid cooling of the engine. Partially richen mixture when descending. Start your descent about 6 miles from your destination for every 1000 feet of height to lose, to arrive at pattern altitude.

LANDING

Make your approach and traffic pattern very cautiously. Most pilots and controllers are accustomed to looking for more conventional aircraft of gargantuan proportions (like Cessna 150's) and may ignore you completely. Best pattern speed is 70 -75 knots (80 - 85 mph) slowing to 65 knots (75 mph) on final approach (70 - 75 knots in turbulence or gusty winds). The Long-EZ is a very clean airplane and you can double the runway length required if you are 10 or 15 knots fast on your approach.

Deploy the landing brake on downwind or base to obtain a normal glide path angle comparable to conventional aircraft. Failure to use the landing brake will result in a flat/wide pattern, more difficult airspeed control and the probability of overshooting your desired touch-down point. Make a complete flare and touch down at 55 knots (63 mph). The nomal landing technique of holding the nose off to minimum speed <u>should not</u> be used in a Long-EZ. Make a complete <u>flare, then</u> fly it down to touch down. This avoids a common tendency to flare too high. While full-stall landings are easily done with some pratice, it is better to land a bit fast on your first attempts, than to run out of airspeed while 10 feet in the air. Maintain a slightly nose high attitude as you roll out and use aft stick to ease the loads on your nose wheel during heavy braking. While the landing gear is strong enough for rough surfaces, the small tire diameters will give the crew a harsh ride. This, combined with the 50 to 55 knot (57 - 63 mph) touchdown speed, makes a hard surfaced runway much more pleasant. If you need to land on a rough field, hold the aircraft off to minimum speed and keep the nose high as long as possible.

CAUTION

<u>Never</u> flare beyond the angle that places the canard on the horizon.

Crosswind landings maybe flown several ways. Mild cross winds are easily handled using the wing-low sideslip aproach. Another method is to simply land in a wings-level crab. The landing gear design makes this technique safe and easy. The best method for strong gusty crosswinds is to approach in a wings-level crab and straighten the nose with the rudder immediately before touchdown. Be careful to not lock a wheel brake, (full rudder) at touch down. The Long-EZ has demonstrated taxi, take-offs, and landings in gusty winds to 45 knots and with crosswind components as great as 18 knots for takeoff and 28 knots for landing.

Fly from long runways until you develop your proficiency. The following runway lengths can be considered as minimums, but only after you have made at least 20 landings on longer runways: with landing brake, 1800 ft, without landing brake 2400 ft.

LANDING GEAR SPEEDS

Don't extend gear above 120 knots (138 mph) at higher speeds the airloads make it hard to extend. The gear can be down or can be retracted at speeds up to 140 knots (163 mph).

CAUTION

If the cg is aft, it is possible to rotate the nose to an excessively high angle during landing rollout, placing the cg aft of the main wheels. Avoid rotation above 12 degrees (canard on horizon), using forward stick or brakes as necessary, to avoid prop damage or tipping the aircraft onto its tail.

CAUTION

If the nose gear mechanism is not lubricated or is binding it maybe difficult to crank down the gear. If this ocurrs, do not force the handle. Slow down to minimum speed if necessary to allow it to crank down easily. Fix the cause of bindingbefore further flight.

CAUTION

With the nose gear extended and without the pilot in the front cockpit the Long-EZ may fall on its tail. The aircraft may initially sit on the nose wheel but may tip backwards when the fuel bleeds throught the baffles towards the aft of of the tank Be sure to brief all ground handlers that the aircraft can fall on its tail unless parked nose down and could also get away from them while moving the aircraft. If your aircraft is subject to being moved by unknowledgable people, ballast the nose or attach a sign to caution them about the possibility of tipping over.

Normal care of the main landing gear strut should always include lifting one wing tip to allow the gear to spring inward ("set" the gear) when parking especially in hot weather. This lowers the stress on the strut and reduces the possiblity of gear creep and loss of alignment.

GROUND HANDLING AND TIE DOWN

The eaiest way to handle the aircraft on the ground is to stand in front of the canard and grasp its top surface with one hand and the elevator slot underneath with the other hand. Do not handle the elevator. Leave the nose gear retracted for ground handling. The airplane balances best with the nose slightly lower than level.

The Long-EZ can be safely left unattended, parked on the nose bumper, in moderate winds. However, it is prudent to always tie down any aircraft whenever possible. For long term parking position the Long-EZ backwards in the parking slot with the nose over the normal tail tie down rope. Install the removeable tie down rings, two near each wing tip and one on the left side of the nose just forward of the canard. "Set" the main gear and securely tie down the wings. Position the nose just to the right of the "tail" tie down and tie the nose securely to the ground against the rubber bumper. An alternate method is to use only the wing tie downs and just weight the nose with ballast. (Be sure it's removed before flight).

LOW SPEED HANDLING AND STALL CHARACTERISTICS

The Long-EZ has good flight characteristics at minimum speed. It is a docile, controllable airplane at full aft stick at its minimum airspeed to 50 to 55 knots. It doesn't exhibit any of the conventional airplane's tendencies to roll or pitch down uncontrollably or other common uncommanded flight path excursions. Any power setting maybe used at full aft stick without changing the way the airplane handles. by adjusting the throttle setting you can climb, descend or maintain level flight. The very low speed range (below 58 knots) is characterized by a doubling of the force required to hold the stick aft, tending to keep the inattentive pilot at a more normal flying speed. Ailerons and rudder are effective at all speeds including full-aft stick flight.

Since the flight characteristics of the Long-EZ are so much better at minimum speed than contemporary conventional aircraft, it hardly seems fitting to use the term "stall" in characterizing the Long-EZ behavior, even though it is technically correct. The Long-EZ'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. Below 60 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 60 knots.

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° bank) by about the fourth or fifth cycle. The "wing rock" should be stopped immediately by relaxing off the full aft stick stop. Prolonged divergent wing rock can result in a uncontrolled roll-off and altitude loss.

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 very slight pitch trim change, neither effect the aircraft's controllability at sustained full aft stick.

Accelerated stalls to 3-g and steep pullups to 60 degrees pitch (min speed, 55 knots) can be done at full aft stick wihtout any departure tendency.

Intentional spins have been 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 pullup results in a lazy spiral which ends up in a steep rolling dive at 3+ g and 100 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 immdediate when controls are neutralized.

You are cleared to do stalls in your Long-EZ in any power, trim or landing condition within the normal operations envelope. Intentional spins (or attempts to spin) are not approved.

NOTE

Experience with the VariEze has shown that some variance in stall characteristics maybe expected from one airplane to another. Inaccurate airfoil shapes, incidence errors, or errors in weight and balance can result in a degradation of the normal safe stall characteristics. Aft of the aft cg limit the Long-EZ maybe susceptable to aft wing stall which, while easily recovered with forward stick, can result in a stall break with high sink rate. If any of your aft-cg characteristics are undersireable, adjust your cg limit forward accordingly.

EMERGENCY PROCEDURES

FIRE

There are normally only two sources of aircraft fires: electrical and fuel. In the event of fire on the ground, kill all electrical power and shut the fuel off. Clear the aircraft. Use a carbon dioxide-type extinguisher. For inflight fire, determine the cause: if electrical, all electrical power off; if fuel, fuel off and electrical power off. Turn the cabin heat-off and open the cabin air vent. Execute a precautionary landing as soon as possible.

ENGINE FAILURE

Modern aircraft engines are extremely durable and seldom fail catastrophically without plenty of advance warning (lowering oil pressure, excessive mechanical noise, rising oil temperature, etc). Pilot induced failures, on the other hand, are far more common (carburator ice, confusion of mixture and carb heat controls, fuel starvation, fuel management, etc.). In the event of inflight engine stoppage, check mixture - RICH, fuel - switch tanks, boost pump on, magnetos, BOTH, and attempt restart. If the engine begins to run rough, check for induction icing, improper mixture setting, or a bad magneto. If carburator heat or an alternate magneto setting fail to correct the roughness, make a precautionary landing as soon as possible and trouble shoot. Lowering/rising oil pressure, rising oil temperature or increasing mechanical noise are good indications of impending failure and flight should be aborted as soon as possible. Don't hesitate to declare an emergency to obtain priority clearance. If stoppage does occure and restart is impossible, execute the engine out approach and landing.

In case of engine failure, the engine will probably windmill above 70 knots. However, as the engine cools down a higher speed maybe required, to maintain engine rotation. With some engines/props a glide speed as high as 100 knots maybe required. Windmilling RPM decays slowly enough to give the pilot time to increase his speed to maintain rotation. Once the prop stops, a speed of 130 knots or more is required to regain rotation (2000 ft altitude loss). This maybe 180 knots/4000ft for the high compression 0-235-F. The pilot should determine when it is no longer feasible to attempt restart, since the best glide angle speeds (page 59) maybe lower than windmill speeds (best glide distance maybe done with prop stopped).

ENGINE OUT APPROACH

If an engine-out landing is unavoidable, check wind direction, choose your landing area and establish your glide at 70 to 75 knots. Gliding performance is shown on page 59 . Remember that with the engine out and prop windmilling, your glide will be considerably steeper than the normal engine-idle glide that you are accustomed to. If you are radio equipped, tune in 121.5 and declare an emergency and give your intended landing site. Shut off the fuel valve. Your landing gear should be down, even for an off-airport landing in rough terrain, or water. This will cushion the landing and keep the nose from slapping down and digging in after the main gear hits. Your glide will be steepened and rate of descent increased with the gear down. Set up the forced landing pattern with the landing brake out and shoot for the middle 1/3 of the force landing area. Therefore if you miss judge short, you can retract the landing brake and possibly still make the field. Turn your electrical power and mags off before touchdown to minimize any potential fire hazard. Touchdown as slowly as possible if landing in rough terrain.

INFLIGHT CANOPY OPENING

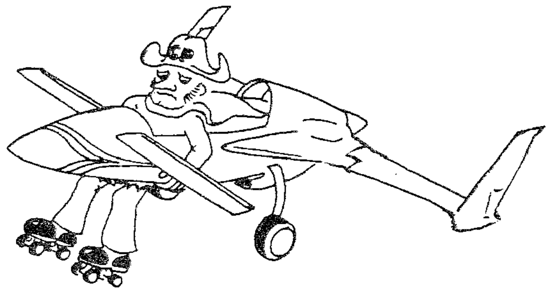
Canopy opening in flight is a serious emergency. With the canopy unlatch warning system and the safety catch, the likely hood of a canopy open in flight is remote. However, should the canopy open to the safety latch, the aircraft is still controllable. Reduce airspeed to minimize wind blast and return and land.

Should the canopy come fully open 90° in flight immediatley grab the canopy rail/handle and pull the canopy down. Be sure to maintain aircraft control. The aircraft is controllable and can be landed safely with the canopy being held down against the fingers.

Remember to maintain aircraft control. Do not be so concerned with closing the canopy that you allow the aircraft to fly unnecesarily into the ground.

LANDING GEAR EMERGENCIES

Since only the nose gear retracts, and it's actuation system is so simple, failure to extend or retract properly is highly unlikely. A far more likely failure is the pilot forgetting to extend the gear. Should you find yourself in the landing flare or even rolling along on the mains at 50 knots or more, you can easily hold the nose off to make a go around or even extend the gear at that point. If you just can't avoid landing gear up, hold the nose off for as long (and slow) as practical, then fly the nose gently to the runway. Avoid nose-high canard stall and the nose dropping hard to the runway.



Damage from landing gear-up should be minor and easily repaired. If you have your choice of landing on known smooth grass, you might minimize the skin damage on the nose, but don't go charging off into the boondocks without knowing the surface conditions. A smooth paved surface is far better than rough grass. The only other gear emergency to be considered is a flat tire. Landing with a flat/blown main tire - make a normal landing touchdown near the side of the runway with the good tire. Use ailerons to hold the weight off the flat tire. Lower the nose and use brakes for directional control. Never attempt to takeoff with a flat tire.

WHEEL BRAKE FAILURE

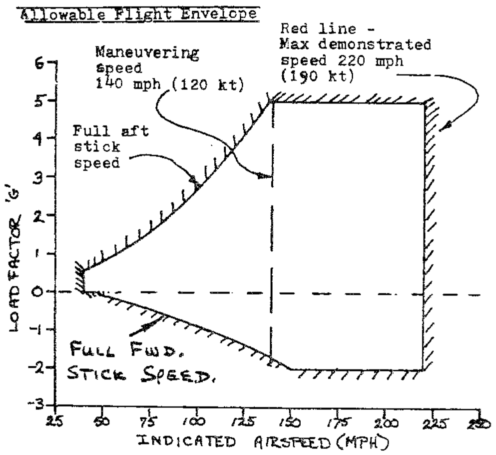
Since the brakes are the only means of directional control after the aircraft decelerates below about 35 knots, landing with a brake out poses a special kind of problem. The risk of damage can be minimized by considering the following: if possible, select a long runway with a cross wind from the side of the failed brake. The aircraft will weather-vane into the into the wind and by careful application of the good down-wind brake, directional control can be maintained.

If it becomes obvious that the aircraft will leave the runway and enter rough terrian or strike an obstacle it might be preferable to retract the nose gear. Caution to keep fingers clear of handle as it may spin up as the nose gear retracts. Doing this may strip the worm gear and will scrape the bottom of the nose. However, this maybe preferrable to running into an obstacle.

The prototype N79RA was successfully landed in calm wind with no damage with a complete failure to the left brake. Two people on a motorcycle rode next to the wing tip and at 35 knots, just as the rudders become ineffective, pushed or pulled on a winglet to guide the aircraft to a stop straight ahead on the runway. It was found that only a very slight tug for or aft was all that was required to keep it straight.

LIMITATIONS

Allowable Flight Envelope.



PLACARDS

Install these placards in the cockpit, visable to the pilot.

Solo - Front seat only
Min Pilot weight xxxx lb.
Max Pilot weight xxxx lb.
Max gear extension speed, 120 knots (138 mph)
Max speed with gear down 150 knots (172 mph)
No aerobatic maneuvers are approved except those listed below:

Maneuver	Recommended Entry Speed*
Candelles	130 knots (150 mph)
Lazy Eights	130 knots (150 mph)
Steep Turns	130 knots (150 mph)
Stalls (except whip stalls)	Slow deceleration
Accelerated Stall	110 knots (126 mph)

* Abrupt use of controls is prohibited above 120 knots.

Crosswind component 15 knot takeoff, 20 knot landing.
Intentional spins are not permitted.
Maximum wind for taxi (all quarters) - 40 knots (46 mph) - Canopy closed.
Fuel tank - Octane - Capacity (near fuel cap)
Red line speed 190 knots (220 mph)
Maneuver speed 120 knots (140 mph
Maximum gross weight 1325 lb.
Center Gravity limits - fwd 97.0 - aft 104.0

ENGINE LIMITATIONS*

	Lycoming 0-235	Continental 0-200
RPM	2800 Max	2750 Max
CHT	500 max 435°F continuous	525°F max 440 continuous
Oil Temp.	245°F max 180°F desired 170°F min continuous	225°F max 150 - 200°F desired
Oil Press.	60 - 90 psi normal 25 psi idling	30 - 60 psi normal 10 psi idling
Fuel	Series C & E 80 octane Series F,L&G 100 octane	80 octane

*Refer to your specific engines operator's manual for detailed operating instructions.

PILOT EXPERIENCE REQUIREMENTS

PILOT CHECKOUT

There is no such thing as a minimum number of total hours a pilot should have, to be qualified for checkout solo in a new aircraft. The best pilot qualification is variety. He should be current in more than one type of airplane The Long-EZ 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 Long-EZ. The Long-EZ has entirely conventional flying qualities. However its responsiveness is quicker and its landing speed is faster than most light training aircraft. It should not be considered as a training airplane to develop basic flight proficiency. The Long-EZ ranks with the best tricycle-geared types for ground stability and has none of the ground-looping tendencies of the taildraggers.

The requirement for a variety of experience applies to checkout in any type of new aircraft, not only to Long-EZ. RAF has never experienced a problem in checking out a new Long-EZ pilot. As of this writing 32 pilots have been checked in the prototype N79RA with no problems. We always follow the following criteria for initial pilot checkout and strongly recommend that you do.

1. Checkout should not be done in gusty winds, particularly crosswind conditions.
2. Use runway at least 3500 ft. long for initial checkouts. The beginning Long-EZ pilot often finds himself fast on approach and the airplane is so clean that it is easy to use up a lot of runway in the flare.

3. Give the pilot a backseat ride or two. This gives him a first-hand look at the aircraft's performance envelope and general flying qualities Trim the airplane up and let him "fly" it from the back seat by leaning back and forth. This will five him an appreciation of the airplane's natural stability. Show him the use of the trim systems, (pitch, and roll). Let him get used to the pitch and roll feel by flying the rear stick control. Do not transition him to the front seat unless he flys the aircraft smoothly and confidently from the rear seat.
4. Have him fly solo on his first flight or change seats until he has the hang of it.
5. Weight and balance must be in the first flight box (page 30)
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 a minimum of 10 hours each in at least two type aircraft in the last 4 months (5 in the last 30 days) and feel competent and comfortable in them during marginal conditions, such as crosswind landings near demonstrated limits, etc.

Initially some of the pilots checked out by RAF tended to do the following on their first takeoff: Immediately after lift-off, they would level off or descend, then re-establish a normal climb. We have found that this is caused by the unusual visual cue provided by the canard wing. Even though the climb angle is similar to other light planes, the canard wing gives the pilot the impression that he has over-rotated. Since we found this was the cause, we have told pilots the following and have found that the pitch "bobble" no longer occurs: rotate smoothly to liftoff at 65 knots.

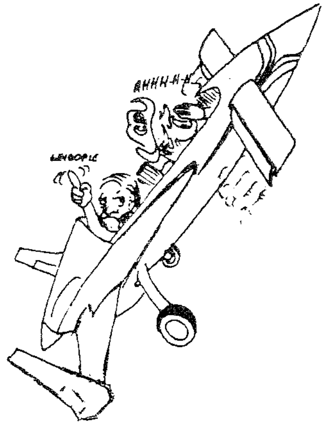
If you think you have over-rotated do not overreact, don't shove the stick forward. Hold the liftoff attitude and the airplane will accelerate to 80 knots for climb.

Occasionally a new Long-EZ pilot will tend to make a "full stall" landing or flare too high. Tell him that if he has made the approach at the correct speed and pulls power to idle before the flare, he should not spend a lot of time in the flare. Make a complete flare, then fly the airplane down onto the runway. For further information on checkouts, refer to flight test procedures, Appendix II. page 40

WEIGHT AND BALANCE

Loading data and sample problems are shown below. Be sure you use empty weight and moment data for your aircraft determined by actual weighing. You can use the simple loading graphs provided for routine service use, but to develop an accurate cg location, use this formula (and your pocket calculator) with the weight vs. fuselage station chart.

Add up the weight and moment totals for your load as shown in the sample problems. Then divide the total moment by total weight, to get the loaded cg position fuselage station (inches aft of the datum; F.S. 0.00). For the light pilot sample, total weight is 1113 lb. total moment is 115706 inch pounds, and the loaded cg is 115706/1113= inches aft of F.S. 0.00 or F.S. 103.96 (at aft limit). The chart shows this weight and cg position to be just inside the acceptable flight envelope as shown (page 30)

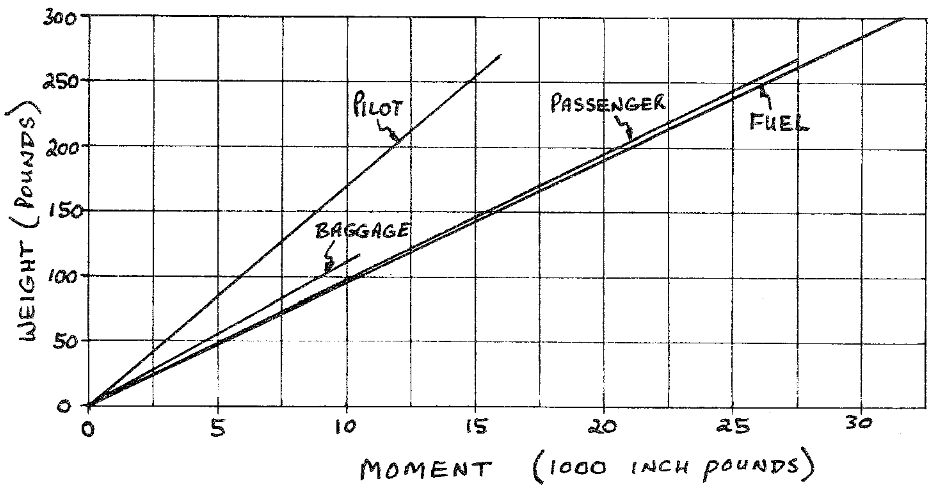


$$\text{cg position F.S.} = \frac{\text{empty moment} + \text{pilot moment} = \text{passenger moment} + \text{fuel moment}}{\text{total weight}}$$

Where: Empty moment is determined by weighing (see page 36)
Pilot moment = pilot weight times 59
Passenger moment = passenger weight times 103
Fuel moment = fuel weight time 104.5
Fuel weight = fuel gallons time 6.0
Total weight = empty weight (weighing page 36) + pilot + passenger + fuel.

Sample Loadings.

Item	Light Pilot Wt	Sta	Moment	Heavy Pilots Wt	Sta	Moment
Empty A/C	730	111.7	81541	730	111.7	81541
Oil	8	140.0	1120	8	140.0	1120
Fuel	240	104.5	25080	150	104.5	15675
Pilot	135	59.0	7965	210	59.0	12390
Pass-engger	-	-	-	210	103.0	21630
Baggage	-	-	-	15	90.0	1350
Total	1113	103.96	115706	1323	101.06	133706



YOUR AIRPLANE

Item	Weight	Station	Moment
Empty A/C			
Oil			
Fuel			
Pilot			
Passenger			
Baggage			
Total			

YOUR AIRPLANE

Item	Weight	Station	Moment
Empty A/C			
Oil			
Fuel			
Pilot			
Passenger			
Baggage			
Total			

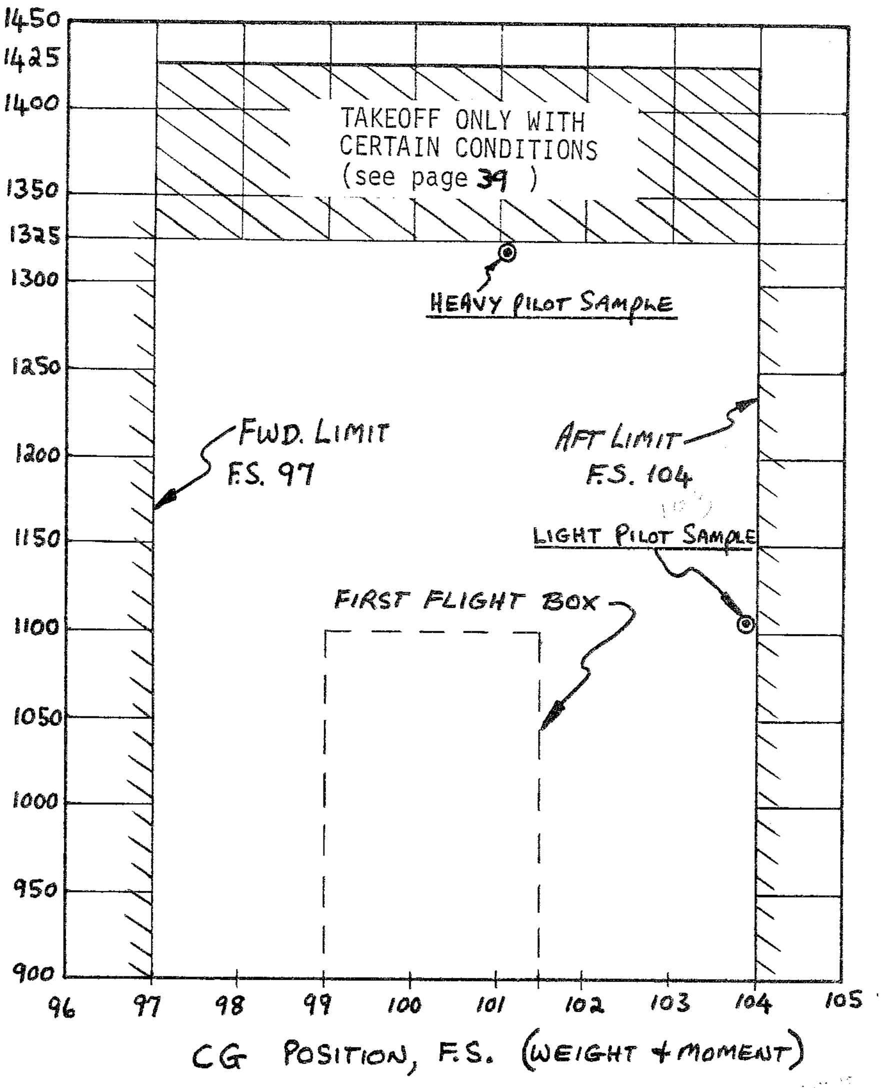
YOUR AIRPLANE

Item	Weight	Station	Moment
Empty A/C			
Oil			
Fuel			
Pilot			
Passenger			
Baggage			
Total			

YOUR AIRPLANE

Item	Weight	Station	Moment
Empty A/C			
Oil			
Fuel			
Pilot			
Passenger			
Baggage			
Total			

Weight and C G Limits.



NOTE

Max gross weight limitations of 1425 lbs is allowable under certain conditions, see page 39 of this manual.

APPENDIX I

INITIAL SYSTEMS CHECKOUT

Before initial taxi testing is begun, each new aircraft should have a very complete inspection and functional test of its flight systems. Factory built aircraft are given a similar series of tests before the pilot ever sees his new mount; however, the Long-EZ owner must perform these production test himself. The following procedure should be used for initial system checkout and for each annual inspection.

General

- Check all fasterners for proper security and safe-tying.
- Check canard attachment bolts for security and proper installation.
- Check wing attachment taper pins, through bolts, and jamb nuts for installation and security.
- Check wing incidence, canard incidence, rudder, ailerons and elevator deflections.

Canard incidence ±0.3°	=	(Use canard incidence template B and C)
Wing incidence Zero ± 0.5°	=	Wings must be within 0.3° incidence of each other. (Use wing incidence templates)
Rudder Travel 6" ± 0.5"	=	Measured at the top of the rudder at trailing edge. Measure this with pilot holding full rudder pedal while someone applies a 5 lb force inboard on the rudder trailing edge, to take any "slack" out of the system.
Elevator Travel	=	22° ± 2° Trailing edge down 20° ± 2° Trailing edge up

Ailerons must both fair into wing at trailing edge when neutral. At full deflection aileron T.E. must travel 2.1" ± 0.3" at inboard end (measure relative to wing T.E.).

CONTROL SYSTEM

- Check that canopy sponge seals are in place and that canopy locking handle is adjusted so it must be forced hard forward to lock. This is extremely important to eleiminate any possibility of it being bumped open in flight.
- Elevator and aileron pushrods for proper installation (spacers, washers, botls, locknuts, clevis pins, and safety clips, installed properly).
- Elevator and ailerons pushrods for freedom of movement throughout control travel.
- Pitch, roll and yaw trim mechanisms for proper function, and freedom of movement.
- Elevator and aileron hinge attachment screws for security and jam nut installation.
- Elevator and aileron for freedom of movement throughout range without binding or chafing.
- Rudder pedals for freedom of movement, cable attachment, and positive return to neutral.
- Rudder pulleys for free rotation and cable guard installation (the four cotter pins on the pulley brackets).
- Cable clearance throughout control travel.
- Brake actuating cable freedom.
- All rodends - reject any with evidence of bent tangs.
- Elevators for proper mass balance - 12° to 25° nose down. Weight evenly distributed between inboard and outboard locations. Max elevator weights with mass balances installed are 3.9 lb left and 3.6 lb right. Check this.
- Ailerons for proper mass balance - level to 10° nose down.
- Check for 1/16" minimum clearances around all mass balances. Binding can occur at elevated load factors if clearance is too small

LANDING GEAR

Main Gear -

- Double check that all attach bolts and axle bolts are installed and secured.
- Check tires for proper inflation pressure (mains 75 to 85 psi, wait 24 hours and see if they leak). Use 40 psi if 500 x 5 tires are used.
- Adjust brakes and test for proper function. Service with fluid as required. Bleed by flowing from drain up to master cylinder. Recheck rudder travel 6" ± 0.5".
- Double check for proper main tire toe-in (¼ to½ degrees per side).
- Wheel bearing packed with grease and safetied.
- Brake mechanism for safetying.

Nose Gear -

- Nose gear tire inflation , 40 psi
- Wheel bearing grease and safety.
- Axle nut for security and proper installtion
- Shimmy damper for friction adjustment (two to four lb.side force at axle is required to rotate pivot).
- Check safetying and security on all actuating mechanism hardware.
- Light grease on worm and wormgear.
- Hold nose up and cycle gear to verify proper function and locking. Verify an over center condition on the NG50. Cycle gear with a 10-lb load to simulate air drag load.
- Verify nose gear warning mic switch is activated in last 1/10" of NG 50 travel.

INSTRUMENTATION

- Cylinder Head temp
- Exhaust gas temp.

  It's important these two gauges be accurately calibrated prior to use. This can be accomplised using hot oil and a high-temp candy thermometer.

- Pitot/static systems - leak check
- Oil Pressure, Tachometer, Fuel Pressure — Function check on initial engine run.

POWERPLANT

Check -

- Clock the prop for compression at the <u>10 o'clock position</u> for proper hand-propping.
- Propeller bolts for proper torque (180 inch-lb) and safetying.
- Propeller track and cracks.
- Spinner track and cracks.
- Engine mount bolts for security and safety
- Oil level
- Mixture, throttle, carb heat controls for security and proper function.
- Magneto wiring. Be sure the mags are cold when the switches are off.
- Check that the magneto impulse coupling clicks at, or after, top dead center.
- Cowling baffles must fit tight all around the engine and cowl. If not, overheating will result.

FUEL SYSTEM

- Check that the fuel caps seal securely and the vent system is clear without leaks.
- Check your valve for proper function. (left, right and off). After flushing the entire fuel system check your fuel filter and carburetor filter (at carb inlet) for contamination.
- Calibrate your fuel gauges with the aircraft level If the fuel doesn't read clearly, sand the gauge area to a very smooth surface with 220 sandpaper and paint on a coat of clear epoxy.
- Check freedom of fuel valve. If it requires more than 10 lb force at handle the valve <u>must</u> be overhauled or lubricated with an approved fuel valve lube.

CAUTION

Under no circumstances should fuel of a lower octane rating than that specified by the manufacturer for your engine be used.
Be sure the minumum octane is clearly labled by each fuel cap. Color coding for 80/87 is red, 100LL is blue and 100/130 is green.
Auto gas especially the high aeromatic content no-lead should <u>never</u> be used.

WEIGHT AND BALANCE

Your finalweighing before initial flight tests is very important and should be done carefully. The measurements taken should be recorded in the airframe log book and used in the weight and balance data kept aboard the airplane (table on page 38).

Equipment required: three scales - platform type are nice, align the scales or use grease plates to avoid side loading scales. Bathroom scales can give inaccurate readings and should not be used. You need a level, a 12 ft decimal tape measure, a plumb bob andline, chalk to mark on the hangar floor, and some ballast weight to keep the nose down on the scales with gear extended. Check the accuracy of your scales by weighing an item you already know the weight of.

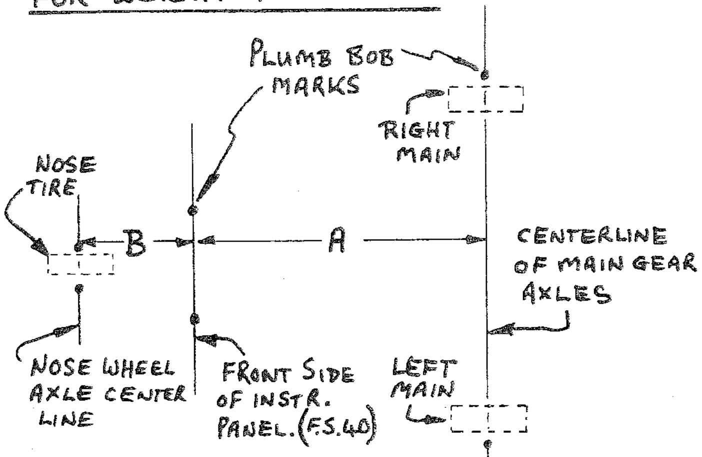
Position the airplane on the scales with the W.L. reference (top longeron) level. Put the ballast in the frontcockpit along the instrument panel (F.S. 40) where your legs go through. Record the scales readings with the airplane alone (no fuel, no pilot, no baggage). Next, with the aircraft off of the scales (still level, though), use your plub line to mark the positions of the main and nosegear axle center lines on the shop floor with chalk. Also drop a line from the front edge of the instrument panel and mark its location. Roll your airplane out of the way and take the measurements shown below: do not omit this step.

Check all fuselage stations of the canard and wings to be sure that your instrument panel reference (F.S.40) is at the proper position relative to the flying surfaces. This is done with the plumb bob to the floor.

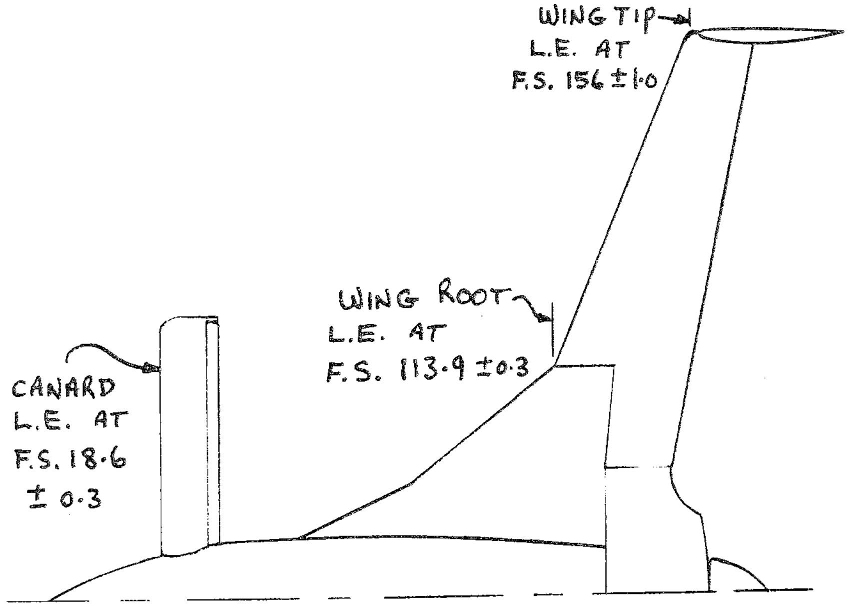
Note that the cg limits relative to the wing is the important reference, not the instrument panel. If your measurements show the instrument panel to not be at the correct station relative to the wing, make allowance to correct the reference and mark the reference in the airplane. The main gear must be at F.S. 110.5 ± 1" to allow correct rotation speed and ground handling.

When loading the aircraft for the intitial flight testing and for initial pilot checkouts, it is important that the weight and cg fall in the first flight box (see page 30). However if a choice of one must be exceeded an overweight condition is preferable to an aft cg condition.

MEASURING REACTIONS FOR WEIGHT & BALANCE.



MARK THESE LOCATIONS WITH LONGERONS LEVELLED.



To get the moment arm (fuselage station) of your main gear, add dimension A (in inches) to 40.0. To get the nosegear arm, subtract dimension B (in inches) from 40 (it should be at about F.S. 20). Be sure to weigh and record the ballast weight and next make a tabulation as shown.

SAMPLE

ITEM	GROSS	TARE	NET	ARM	MOMENT
Scale R. Main	374.7	-1	373.7	110.5	41294
Scale L. Main	370.0	+2	372	110.5	41106
Scale Nose	9	-1.8	7.2	19.6	141
Ballast	-25	0	-25	40.0	-1000
Total = Empty Weight =			730	111.7	81541

Your Aircraft

ITEM	GROSS	TARE	NET	ARM	MOMENT
Scale R. Main					
Scale L. Main					
Scale Nose					
Ballast					
Total = Empty Weight =					

Divide total moment by total net weight (81541/730) to get empty cg (111.7) Remember that you have to subtract the weight and moment of the ballast.

Now, record the empty weight and moment (730 and 81541 in the sample above) for your airplane on the table on page 28 . Determine (trial and error) the maximum pilot weight with zero fuel and no passenger, which will stay inside the forward cg limits on page 30 Do the same for the lightest pilot using your empty weight and moment, full fuel and no passenger to determine lightest pilot for aft limit cg. Once these weight limits are determined, placard your aircraft accordingly. As an example the placard can read:

Front Seat Pilot Weight Limits	
Maximum	243 lb.
Minimum	135 lb.

SAMPLE

If you desire to raise or lower the range of allowable pilot weights, you may do so by moving the battery or adding ballast. Remember, you must do initial testing in the first flight box. Mid cg gives the best overall flying qualities.

Use the loading charts on page 28 and try several sample problems with different pilot weights, fuel loads and passenger weights to develop an understanding of your loading capability.

CAUTION

Operations above the designed gross weight limitations as stated in this manual, is a high risk activity and an extremely hazardous practice.

NOTE

A maximum gross weight, for takeoff only of 1420 lb maybe used, but only under the following limitations:

1. Taxi and takeoff only on smooth hard surface. Use the 6 ply industrial rib tire or equivalent with 80 psi inflation.
2. Maximum landing weight limited to 1325 lb.
3. Maneuvers limited to normal category +3.8 , -1g. No abrupt maneuvers.
4. Refer to gross weight takeoff distance. See chart page 53 . Lift off at 70 knots (80 mph) and climb at 95 knots (110 mph) see chart page 54 .
5. Before conducting over-gross operation the pilot should be a proficient/competent Long-EZ pilot with at least 50 landings in the aircraft. The pilot should not attempt high gross operations at high density altitudes or gusty crosswinds. Max cross wind component is 8 knots.
6. High gross weight operations should not be considered a routine operation since the chances of surviving an off-airport forced landing diminish rapidly as weight goes up. It should only be considered on those rare occasions when a long range, full fuel two place operation is desired. Routine operations above 1325 lb gross weight are not recommended.

APPENDIX II

FLIGHT TEST PROCEDURES

As you complete the final checkout on your new airplane, you are going to be hot to fly your first flight. You may push a little too hard at the last minute and try to fly prematurely, possibly with something wrong with your airplane. To avoid this 'homebuilder syndrome' give the only key to your bird to a close friend (preferably one who really likes you and to whom you owe money) and give the absolute authority to say "go" or "no go" to your initial flight tests. With all the other things you are thinking about, it's best togive the decision (of whether the airplane is ready) to someone else. If you really get a bad case of 'homebuilder's syndrome' your friendship may be strained somewhat, but you will be able to make up after you have tested your new bird safely. A little champagne seems to help!

This'homebuilders syndrome' has been a major factor in many first-flight accidents. Typical of this problem is where an individual spends all his time and money building his airplane and, for several years, lets his flying proficiency lapse. Very typically we find a finished homebuilt with the owner/pilot seriously lacking in pilot proficiency. In one case the pilot who tried to fly the first flight on his homebuilt had only one flight in the last two years!!! Another problem surfaces about the time the aircraft is ready to fly - "Ego", that is " I built the machine, I'll fly it. After all who knows more about my machine than me - - I built it". The homebuilder is understandably proud of his creation and becomes very possessive. So, we find the proud builder/pilot at the end of the runway "ready" for takeoff with possibly a bad case of 'homebuilder syndrome'. But he won't know it until just after lift off when he finds himself suddenly thrust into an enviroment he is ill prepared to handle.

The best remedy for 'homebuilder syndrome' is to accept help on your flight testing from an experienced Long-EZ or VariEze pilot. Then get a good checkout from him after you meet the currency requirements on page 26.

GROUND TESTING

Don't just race out and fly your airplane first thing. You will spend awhile checking out all of your systems on the ground before you leap off on the first flight. The first order of business is to check out your engine system thorougly. Ground run it for an hour or so at low to meduim power. Run it with the top cowling off and look for excessive vibration, unsafetied hardware, leaky fuel lines, or anything else unpleasant. After this initial run-in period (or the manufacturere's recommended run-in for new or overhauled engines), check everything over very carefully. Recheck the exhaust nuts for torque, look for leaks around gaskets, loose clamps, check fit of cowling baffles etc. Check everything thoroughly before you button up the cowling to begin taxi tests. Be sure the engine compartment is clean. Check for nuts, washers, bits of safety wire etc. because in a pusher everything that comes off goes right through the prop.

Are you sure you have complied with all details in Appendix I ?

LOW SPEED TAXI

Make all initial taxi/runway flights without wheel pants for better brake cooling.

Refer to "pilot position" page 9 , to set up the seat for correct visibility. Low speed taxi is defined as that slower than required to lift the nose wheel off the ground - 35 knots (40 mph). Spend at least a full hour doing low speed taxi to fully familiarize yourself with the cockpit enviroment and to thoroughly check the engine, brakes, controls, landing gear etc.

Thirty five knots is sufficient speed to evaluate rudder steering and brake effectiveness. You may find that extensive taxiing can overheat the brakes. At 35 knots you will note that the floppy feel of the control stick is gone and airloads now provide a comfortable centering feel.

Recheck that your weight and balance is within the "first flight" box on the diagram on page 30. Recheck wing and canard incidences and control travel and freedom before proceeding. Now is the time for the final FAA inspection and issuance of your airworthiness certificate.

HIGH SPEED TAXI & NOSE WHEEL LIFTOFFS

Before conducting the following tests with your new Long-EZ, do all of them first with two other different airplanes in which you are proficient. These maneuvers (nosewheel liftoffs 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 wind conditions.

Some of the following requirements and procedures may seem excessive. This is not due to any special feature of the Long-EZ; we feel they should be required of any homebuilt during their initial testing. The safety record of homebuilts during first flights is not as good as it could be if the owners and pilots would follow the following cautious procedures during initial testing.

- Weather - wind calm or smooth wind straight down the runway. Smooth air - check turbulence in another airplane.
- Runway - at least 3500 ft, preferably over 4000 ft
- Fuel - 10 gallon each tank
- Pilot - see pilot experience requirements - page 26 for absolute minimum criteria. Do not test fly a new airplane while fatigued: go home, get some dinner, sleep, you're more alert in the morning.

The reason for the long runway requirement is to allow you to do nosewheel lift-offs and decelarations without concern for stopping distance or brake heating. The air must be smooth and without crosswind. Set the pitch trim for takeoff. Set neutral roll trim.

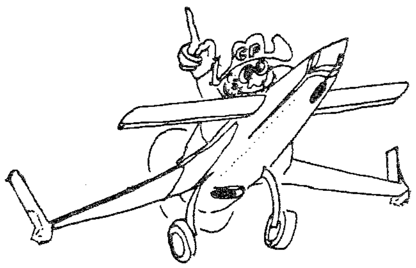
The purpose of this phase of testing is to evaluate the aircraft's performance and trim during high speed taxi/nose wheel liftoffs, to acquaint the pilot with the pitch and yaw characteristics of the Long-EZ, and, most importantly, to give him the correct visual cue of zero height to allow him to judge flare height on his first landing. The pilot should spend enough time just below rotation speed to be thoroughly proficient/comfortable with the unique Long-EZ rudder system. There should be no tendency for the pilot to inadvertently push/deploy both rudders at the same time, unless during braking.

Next step is to practice speed control before attempting nose wheel lift offs. It's important to be able to control speed accurately so as not to get airborne inadvertently. You will find that once a speed is attained it takes VERY LITTLE power to maintain it. Practice accelerating to and maintaining different target speeds. (30, 40, 50, 60 knots) Do not rotate.

You will find that once the target speed is reached you must reduce power to idle or just a "hair" above to keep from exceeding it. Be proficient and comfortable in holding speed before moving on to nose wheel lift offs. The aircraft will rotate at different speeds depending on gross weight and center of gravity. To determine rotation speed, accelerate to 40 knots, set power to maintain speed (close to idle), then attempt to rotate. If 40 knots is too slow to rotate, then go back to the start and try 45 knots etc. Find the speed that will just rotate the nose (about 55 knots), reduce power to near idle and practice holding the nose at a predetermined position. Be carefull to not over-rotate. Always keep the canard well below the horizon. The pilot should not allow the aircraft to exceed 60 knots or rotate to a point of becoming airbourne during this exercise. .

When you've done enough runs downthe runway so that you can comfortably, smoothly and precisely control speed, pitch and yaw with the nose wheel off the ground, you should be ready for the first flight.

FIRST FLIGHT



You should be proficient in rudder operations and positve control of pitch control and are ready for the "big one". But be sure you review and understand the following:

The Long-EZ does not fly like a Cessna 150 or some other sluggish trainer. The Long-EZ is a 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 depoloyed simultaneously and the pilot should be careful not to inadvertently do this in flight.

There are two differences in a Long-EZ that must be thoroughly understood prior to flight.

1. The non-standard rudder pedals. Be sure not to inadvertently deploy both rudders at the same time in flight. If this happens one will usually be out more than the other producing unwanted yaw. The Long-EZ rudders are quite effective. Adjust the pedals so your foot does not press the pedals naturally.
2. Pitch over-controlling. The novice pilot will expect the Long-EZ to handle like the C-150, or whatever, he last flew. The experienced pilot knows that J-3 Cubs and Bonanzas handle differently 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 the wrist only. Do not over-rotate! The highest rotation you should see duringthis 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.

Remember the first flight of your aircraft is just one baby step up from the lift off that you've just completed and is just the bare beginning of your flight test program. First flight should again be made under ideal weather conditions. The weight and cg position should be within the limited envelope shown on page 30 for initial flight tests. First flight is not intended to demonstrate the capability of your aircraft or of the pilot and should be flown very conservatively. Leave the gear down and give yourself one less thing to worry about. Limit your airspeed to a range of from 70 knots (80 mph) to 130 knots (150 mph), stay over the airport and resist the urge to buzz your observers. Buzz jobs on first fights are done by fools, never by professional test pilots. During your climb out, set your pitch and roll trims to trim the airplane for hands-off flight. This will be a handy reminder of trim direction, if the airplane needs adjustment. You will notice a small roll trim change when you reduce the power. The airplane will require more right trim with power off. Limit your first flight to feeling out roll, pitch and yaw responses and checking engine operation, temperatures, pressures etc. Make your approach at 75 knots (86 mph) and make a slightly fast touch down (65 - 70 knots), leaving full stall landings for later in the test program.

After this first flight make a thorough systems check, clean and flush the gascolator, electric fuel pump screen, and carb screen. Also remove and clean out carb float bowl. Check float needle valve and seat for cleanliness.

ENVELOPE EXPANSION

With first flight completed and any squawks resolved, you are ready to expand your flight envelope. Do not promptly charge out and test fly your aircraft at the extreme cg position and weights shown on page 30. Expand your envelope in small increments. Remember, you have to spend 40 hours in your test area, so put the time to good use and do a professional job of flight testing. Before expanding the weight and cg range shown for initial testing, spend a few hours and become thoroughly comfortable in your piloting tasks. When you feel at home in the airplane, begin your expansion of the weight, cg position, load factor and airspeed ranges. Don't feel obliged to expand into the full ranges shown in the plans and in this handbook. Expand your limitations slowly, and if you reach a point that you feel uncomfortable, stop. The ranges shown are those demostrated by the designer. Feel free to restrict your airplane as you determine in your own testing; just don't exceed the design limits shown.

Do not assume that your aircraft will fly exactly the same as N79RA, the Long-EZ prototype. Minor homebuilder contruction tolerances can effect flying qualities and performance; for example, your aircraft may exhibit less or more stall margin. As with any aircraft, completely determine your stall characteristics at a safe altitude, then operate your aircraft accordingly.

After you complete the expansion of the cg envelope onyour aircraft, you may want to change the placarded min. and max. pilot weights to those in which you are comfortable.

Some words of general caution - Wear a parachute for your flight testing. Never leave a squawk unresolved; find and fix problems as you encounter them. Airplanes usually give a hint of impending trouble. The problem is we pilot don't always listen. If something changes: a slight roughness/vibration, new oil leak, trim change new squeek etc. look until you find it - don't rationalize it away. Have bunches of fun.

FLIGHT - FLUTTER ENVELOPE EXPANSION

The first time you exceed 130 knot (150 mph) it should be done wearing a parachute and at a height of at least 7000 ft AGL. You should expand the airspeed envelope in increments of not more than 5 knots. At each increment, access the damping of the controls as follows: kick a rudder pedal, and jab the stick left, right, forward and aft. After each input the controls should immediately return to trim and any structural motion should damp within one cycle. This will require at least 3 or 4 dives, climbing back to altitude between dives. Do not expand airspeed in the dive when below 7000 ft AGL. Use care to not overspeed the engine RPM. If you have just increased speed and find lower damping (ie, the structure or controls shake more after the jab than at the 5-knot lower speed), do not continue to higher speeds. Recheck balance and weights of control surfaces. Solve any suspected cause of low damping before expanding airspeed. Expand speed to at least the red-line speed you desire to place on your aircraft, up to, but not exceeding 190 knots (220 mph). Placard your airspeed indicator with your red line.

APPENDIX III

Maintenance/Inspection

Composite Structure

The Long-EZ is painted with a white acrylic enamel or lacquer. UV Barrier is used (dark primer) to protect the epoxy and foams from deteroration. Do not expose unprotected fiberglass to sunlight for extended periods. Unpainted areas should be retouched. The high surface durability and high safety margins designed into the Long-EZ make it highly resistant to damage or fatigue. If the structure is damaged, it will show up as a crack in the paint. The strain characteristics of the material are such that it cannot fail internally without first failing the paint layer. If damage is apparent due to a crack in the paint or wrinkle in the skin, remove the paint around the crack (by sanding) and inspect the glass structure. Do not use enamel or lacquer paint remover. If the glass structure is damaged, it will have a white appearing ridge or notch indicating torn (tension) or crushed (compression) fibers. If there is no glass damage, it will be smooth and transparent when sanded. If there is glass structure damage, repair as shown in Section I. Delaminations are rare, due to the proper design of joint (none have occurred on the prototype). If a delamination occurs (skin trailing edge joints, etc.) , spread the joint, sand the surfaces dull, trowel in wet flox, clamp back together and let cure, or use the method in the construction manual.

Inspect suspected debonds (areas where skin has separated from the foam) by tapping a 25¢ coin across the surface. A debond will give a "dull thud" compared to the "sharp knock" of the adjacent good area. Debonds must be repaired by injecting epoxy in one side of the area and venting the air out the opposite side.

Plexiglass Canopy

Due to the uniform frame and lack of metal fasterners, the Long-EZ canopy is not as susceptible to cracks as the common aircraft plexiglass component. If a crack up to three inches does occur, stop drill it just outside the crack with a 1/8" drill. Cracks longer than three inches require replacement.

Schedules Maintenance/Inspections

In addition to the schedule listed below follow the manufacture's recommendations for inspection/maintenance on items such as the engine, accessories, wheels, brakes, batteries etc.

Each 25 Hours

Inspect the prop and spinner for damage/cracks.
Prop bolts - check torque (wood prop 180 in/lb) and resafety. Check after initial run, at 10 hours and 25 hours thereafter

CAUTION: Prop bolts - recheck torque (180 in./lb) 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 propellor.

Engine Cowl - Remove and check baffling for cracks.
Engine Oil Change - (50 hours for spin-on paper element filter)
Engine Oil Screen - (back accessory section) clean first oil change and every other thereafter.
Fuel Filters - remove and clean (gascolator, electric fuel pump carb finger strainer).
Carb Float bowl - disasemble and check for contamination. Inspect float needle valve and seat. Look for a gummy substance, clean if neccessary. Perform this inspection each 25 hours until 100 hours, then each annual/100 hours thereafter.

NOTE

Any contaminates (foam - flox, dust/chips etc), left in the fuel system during construction could take 50 hours or more to be completely purged from the system. Check the filters often during the first 100 hours. Contaminates can stick in the gascolator drain valve causing a slight leak. If this happens remove the bowl and flush the valve.

Exhaust System - check for cracks, leaks and security. Carefully check the four exhaust gaskets for leaks.
Never reuse an exhaust gasket.

NOTE

It is very important to avoid exhaust leaks if using a cabin heater to prevent fumes entering the cockpit.

Air Filter - check and replace (if neccessary)
Brake fluid level - check
Cables, push rods, fuel/oil lines and electrical wires - check for chaffing.
Fuel System - pressure check (electric pump on) for leaks and correct pressure - 2 to 8 psi.
Engine Run - check for leaks, mag drop, mags grounded, idle speed/mixture and idle mixture cut off.

Landing gear attach fittings - check for security or damage.
Fuel Vents - check open.
Canopy - Check hinges for damage, locking mechanism for rig/snub, safety catch operation.
Tires and brakes - remove wheel pants, check tire inflation 70 - 80 psi mains, 40 - 45 psi nose, cuts wear and brake pucks for wear. Adjust nose wheel friction damper 2-4 lbs side force should be required to swivel the pivot.
Nose gear retraction - grease worm gear. Check for damage, wear and gear-down warning micro switch adjustment.
Lights - Nav, landing, strobe, cockpit, check operation.

ANNUAL/100 HOURS

Accomplish all the items listed in the 25 hour inspection guide, plus all items in Appendix I page 31, except weight and balance.

Review the Canard Pusher newsletter #24 and subsequent for any outstanding airworthiness directives. Also any FAA ADs that would apply to certified components/ accessories. Be sure all are complied with prior to returning to service.

Review the weight and balance/equipment list for currency. (Airplanes are like people they get heavier with age). The aircraft should be reweighed at the first annual, you maybe surprised. Update the weight and balance form. Reweigh every 3 years, or after any major modification.

Nose and Main wheel bearings - repack
Air filter - replace
Engine - Reference to Manufacturers inspection manual be sure to check mags grounding/timing clean and gap spark plugs (.018"). Reverse top to bottom. Check compression. If below 70/80, investigate. Ops check engine controls throttle, mixture, carb, lube and check for feedom of operation.
Control system - Inspect and lube all hinges, rodends, jam nuts, bearings, check for binding.
Canard - remove the canard (see page 49) and inspect rudder pedals, battery, nose gear retraction mechanism canard lift tabs for damage/elongation, elevator torque tubes for damage, elevator balance weights for security/ binding.
Pitot static system - check for leaks.
Canopy locking hooks - check rig (all three making equal contact) and proper snub. The handle must be adjusted so it has to be firmly pushed forward to engage the lock.

Wings - remove both wings (see page 50) and inspect the glass areas around the center section spar and wing attach fittings. Look for cracks, delaminations etc. Note that the reason for this inspection is not based on any anticipated problem or failures, but to insure that the aircraft, at least once each year, is given a thorough structural inspection.

Inspect the entire surface of the aircraft. Look for evidence of cracking/delamination or deformity of any kind. See composite structure page 46.

NOTE

The composite material structural history in over 40,000 total VariEze flying hours has never indicated a reason to be concerned about structural integrity. This annual strutural inspection is important though, to indicate at an early stage any problem that needs attention. Report any structural defect to Rutan Aircraft Factory.

CANARD REMOVAL/INSTALLTION

You can remove the canard by yourself in about 5 minutes. Tools required: one 7/16" socketwrench and screw driver. First weight/ballast the nose so it won't tip over with the weight of the canard removed. Remove the nose access cover, disconnect the nav antenna and unhook both pitch trim springs on the left side of the cockpit. Remove the elevator push rod quick disconnect pin on the right side of the cockpit. Reaching in through the nose access hole forward of the canard, remove the two AN-4 main canard hold down bolts. These bolts screw into nut plates behind the bulk head so no back up wrench is required. Remove the bolts, lable them (they maybe different lengths) and record the number of washers used. There are no washers between the canard lift tabs and the bulk head. Carefully lift the canard up and forward. Set the canard upside down on foam blocks or soft material as to not scratch the surface. Be especially careful of the elevator pushrod that it does not get kicked/bent by an unknowing passerby.

To install the canard, slip the push rod into the fuselage and lower the canard into position. Hold the canard slightly leading edge high, engaging the locating pins and then slide the canard into position. Be careful not to get the nav antenna cable between the canard and the bulkhead. Next, install the two AN-4 canard main hold down bolts through the canard tabs into the nut plates on the aft side of the bulkhead. Add the correct washers under the bolt heads (not between the tab and bulkhead) so the bolts will tighten without bottoming prematurely in the nut plate. Caution - bolt length maybe different left/right. These bolts should be snugged well (about 30 inch/lb) but not over-tightened. Reconnect the nav antenna, pitch trim springs and elevator push rod quick disconnect. Perform a composite operational check Nav, trim, and elevator systems. Recheck the AN-4 bolts (in and torqued). Note: A VariEze attempted a takeoff without these bolts in - fortunately only the canard flew). Replace the nose access cover.

WING REMOVAL

To remove/install the wing you must have an assistant. This operation should take no more than 8 - 10 minutes per wing. Tools required: screw driver (cowl removal), two 3/4" 3/8"-drive sockets, two 3" extensions, one 3/8" drive ratchet, one 3/8" drive breaker bar. Procedure: Remove the cowling, disconnect the aileron push rod and the rudder cable using the quick disconnects. Disconnect the Nav/Strobe light wires. Remove the three wing access attach hole covers. Support the wing tip and proceed to remove the three main wing attach bolts. To remove the two outboard bolts use the ratchet on the wing side and the breaker bar in the lower spar hole. The single inboard bolts access is from inside the cowling area in the wing root. Access to the nut for this bolt is from inside the centersection spar accessable from inside the back cockpit.

> **CAUTION**
>
> Be sure the nose is weighted/ballasted so as not to fall over backwards while working in the rear cockpit. Especially if the canard is removed.

When the three main wing attach nuts are removed, support the wing and slide it aft, off the aircraft. Note the number and position of each incidence shim washer on each bolt. These shims control the incidence of the wings and should be replaced exactly as they come off. Set the wing on foam blocks or soft material to protect the surface from damage. The procedure is the same for both wings.

WING INSTALLATION

To install the wings use the reverse sequence listed above. Be sure the nose is weighted/ballasted down so the weight of the wings won't tip the aircraft over on it's tail. Recheck for the correct number of incidence shims on each bolt. Torque the bolts to between 150 - 200 inch lbs. since you cannot get a torque wrench in the access well , it's acceptable to just estimate the torque. These bolts are not highly stressed in application (contrary to normal wing attach bolts) and accurate torquing is not required - just snug them up. Be sure that at least two threads show outside each locknut. Be sure to hook up and run a complete operational check of the ailerons, rudder and lighting prior to flight.

APPENDIX IV

FAA RECORDS

Records required for the Long-EZ are basically the same as for any production airplane (F.A.R. 91) A valid airworthiness certificate, issued by a FAA maintenance inspector, is required to be displayed in the cockpit, along with the aircraft registration certificate, weight and balance record and operating limitations. Airframe and engine log books are required as in any other aircraft. One area which is different from production aircraft is the method for maintaining records of major repairs and alterations. A major repair or alteration of the Long-EZ requires relicensing and issuance of a new airworthiness certificate and operating limitations instead of using FAA from 337A/ Radio equipped aircraft must also have a valid F.C.C. radio telephone license.

FILL IN THE FOLLOWING TO COMPLETE THE DESIGN DOCUMENTATION OF YOUR AIRCRAFT:

1. This aircraft was built to the drawings described in Long-EZ manufacturing manual.

   Yes______________ No______________

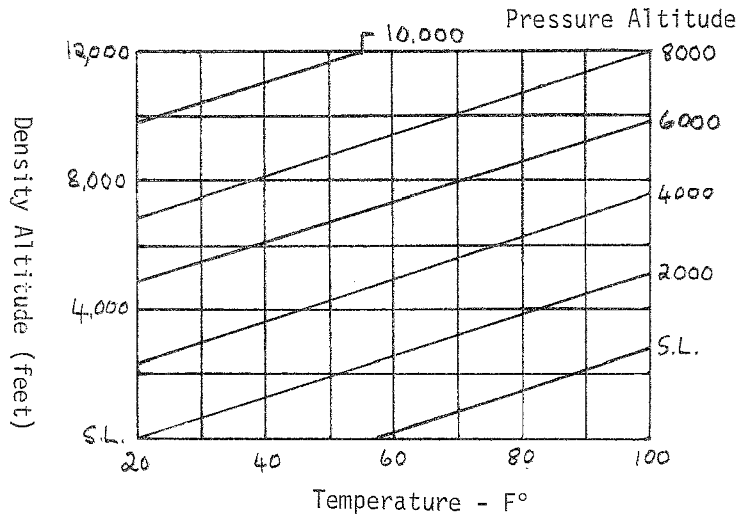
2. Rutan Aircraft Factory Inc. has assigned serial number ______________

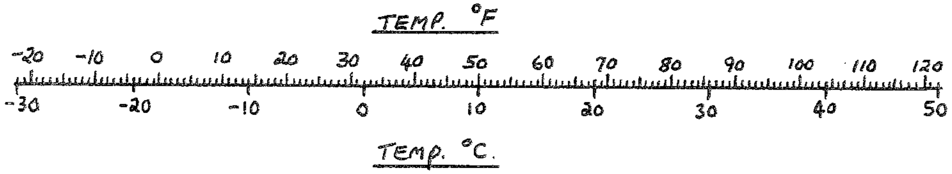
3. Modifications are completely documented as shown (if you have modified the design, you should make a drawing to show the change).

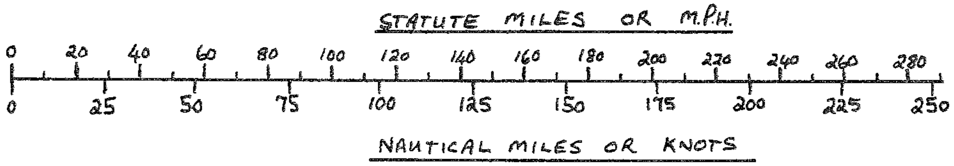
Modification	Drawing No.

APPENDIX V
PERFORMANCE DATA

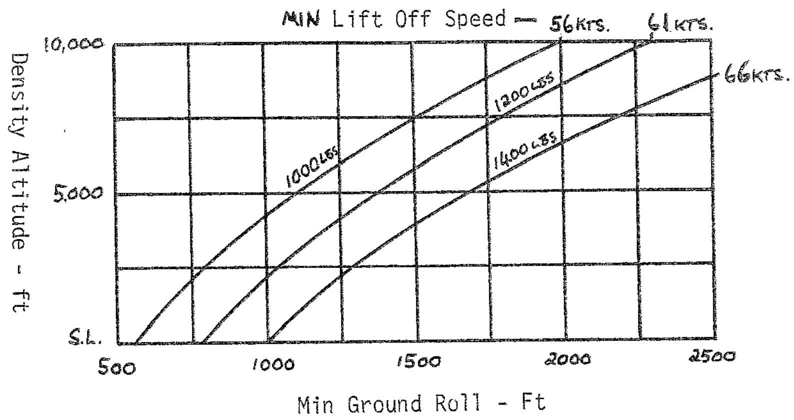
To determine density altitude

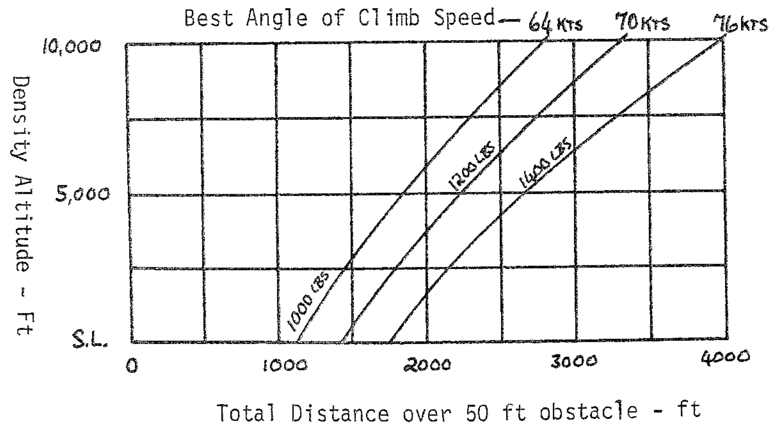






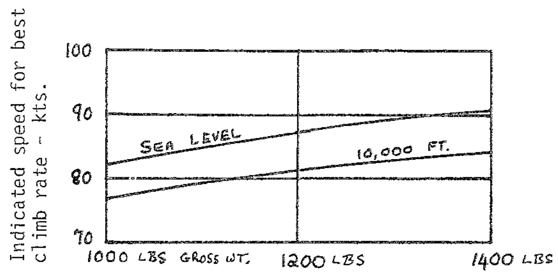
TAKEOFF DISTANCES





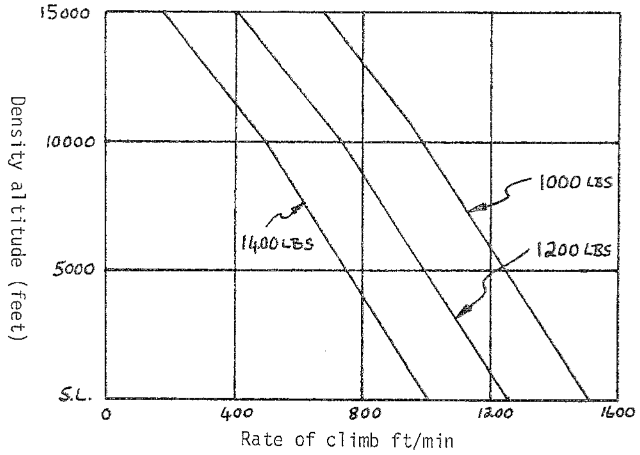
Note: (1) Data for Lycoming O-235 and Ted's 58 x 72 or B & T's 58 x 67 props. Multiply data by 1.2 for O-200 Continental engine.
(2) Due to brake steering requirements, crosswinds can extend takeoff roll. For a 15 knot crosswind component multiply takeoff roll data by 1.25.
(3) At forward cg the nosewheel lift off speed is higher than the "min ground roll lift off speed". This can extend takeoff distance as much as 20% at max forward cg.

Climb Speeds

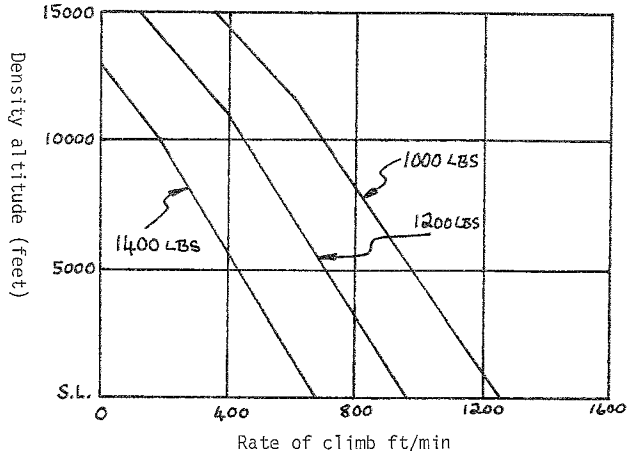


Note: For best cooling and visibility, normal climb is 20 kts faster than data shown.

Maximum climb, best power mixture

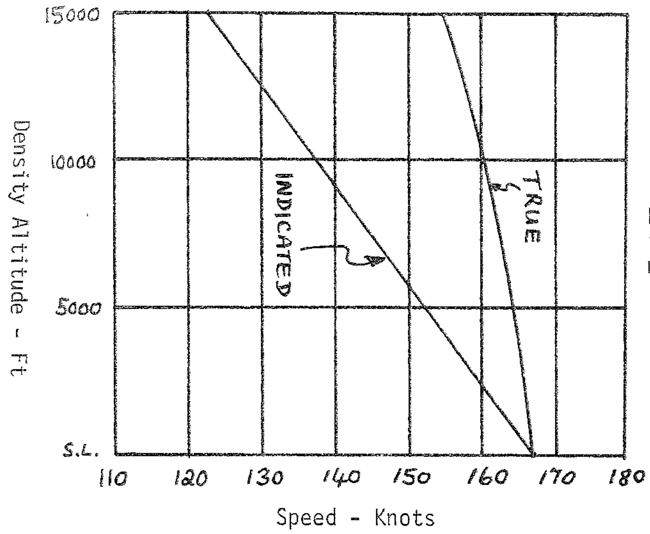


0-235 Lyc. Data for Ted's 58 x 72 or B & T 58x 67 prop.

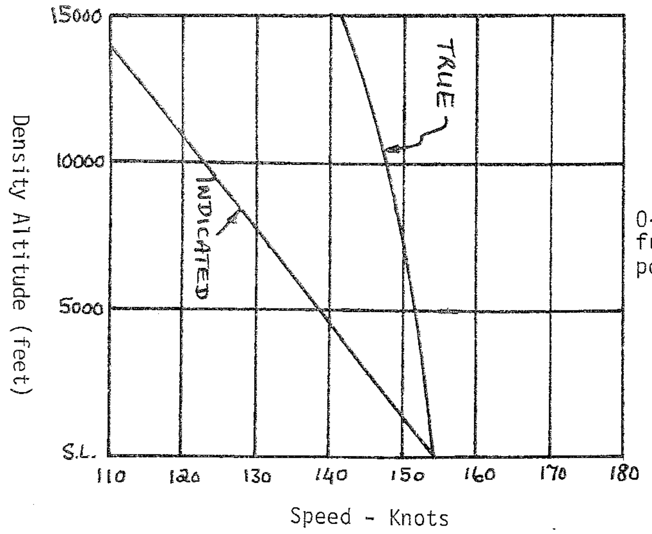


0-200 Continental Best power mixture.

Maximum speed for level flight, data with wheel pants, for no pants - substract 5 knots.

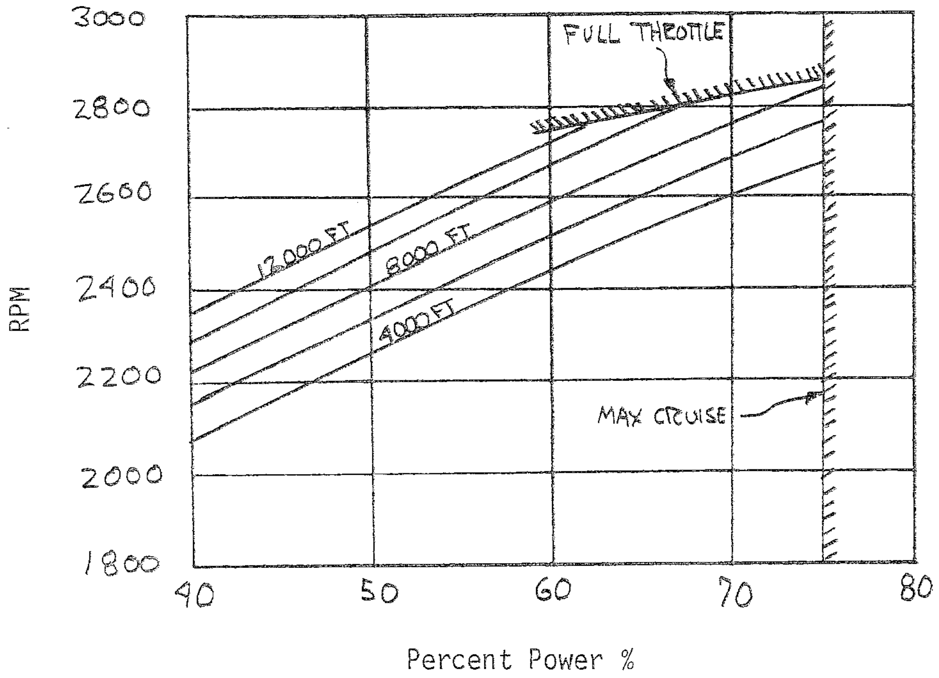


Lycoming 0-235, full throttle, best power mixture.



0-200 Continental, full throttle, best power mixture.

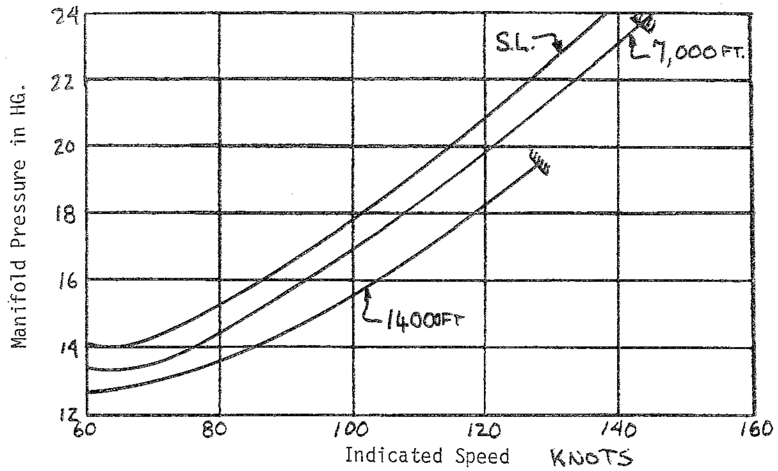
Approximate Chart to set Cruise Power.
0-235 Lycoming
Ted's 58 x 72 or B&T 58 x 67 Prop.

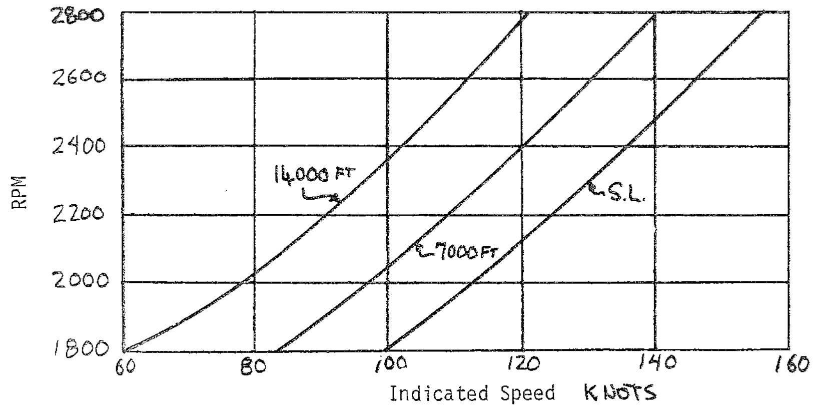


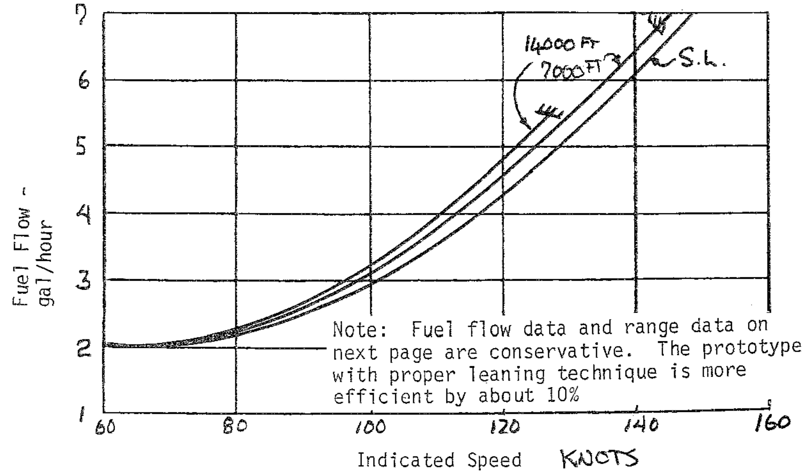
Note: Max continous cruise speed (161 knots true) is obtained at 8000 feet altitude with full throttle (2840 rpm, 6.7 gal/hr). A good economy cruise condition is 2550 rpm at 12,000 feet altitude (50% power, 4 gal/hr) resulting in a true air speed of 137 knots.

Cruise Data
1100 lb weight
0-235 Lycoming
Peak EGT mixture

Ted's 58 x 72 or
B & T's 58 x 67 prop

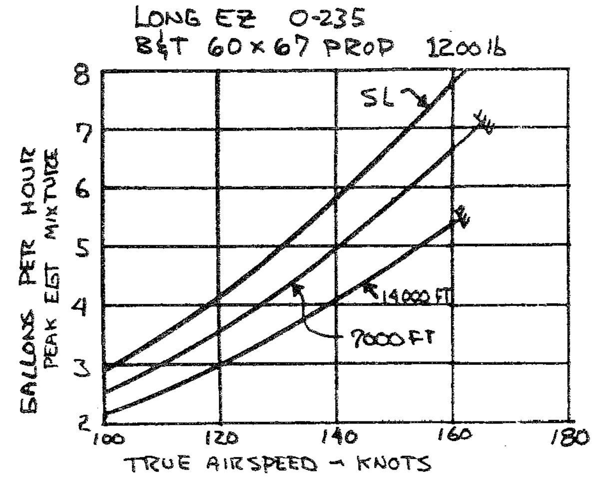


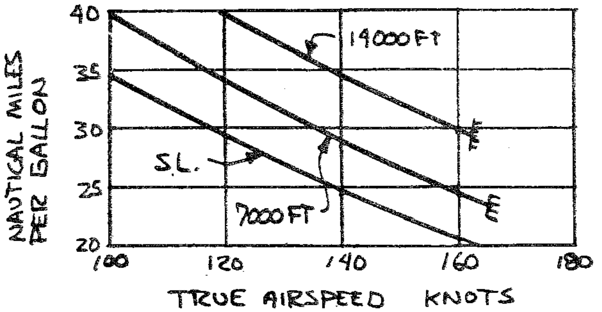




Note: Fuel flow data and range data on next page are conservative. The prototype with proper leaning technique is more efficient by about 10%

FLIGHT PLANNING CHART CRUISE SEGMENT.





Leaning for Cruise

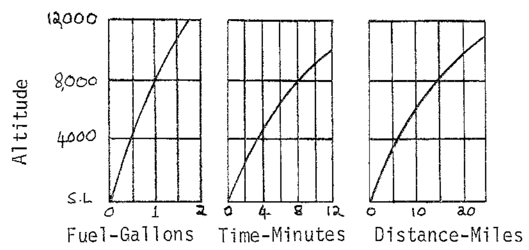
Few pilots realize the extent of fuel economy benefits available when an engine is leaned to proper "best economy" (BE) settings. Due to cooling requirements, BE setting (50 degrees F of lean side of peak EGT), is allowed only below 65% power. Lycoming-supplied data shows that at BE, specific fuel consumption is 14% lower than 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% more fuel than at the BE setting! Always lean at least to peak EGT when cruising with less than 65% power.

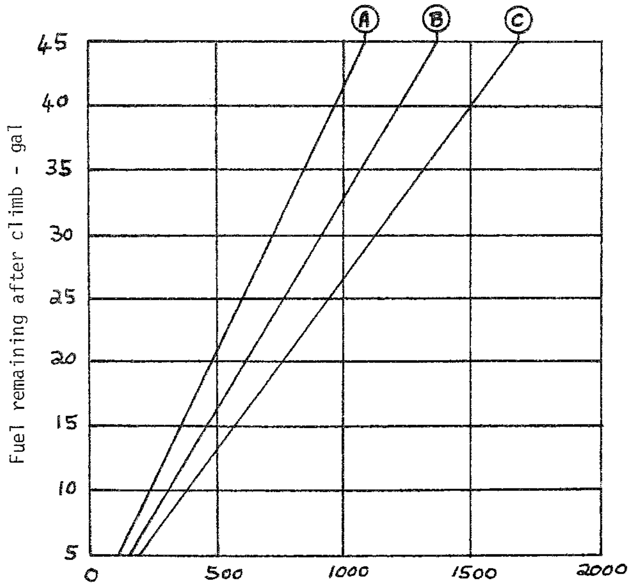
RANGE

To calculate range.

(1) Subtract 4 gal. from total fuel, for reserve.
(2) Figure climb fuel and climb distance (top chart)
(3) Subtract climb fuel and look up cruise range from lower chart.
(4) Total range is climb distance plus cruise range.

Fuel, time and distance to climb.
Gross weight = 1325 lbs.
90 kts indicated, Lycoming 0-235.





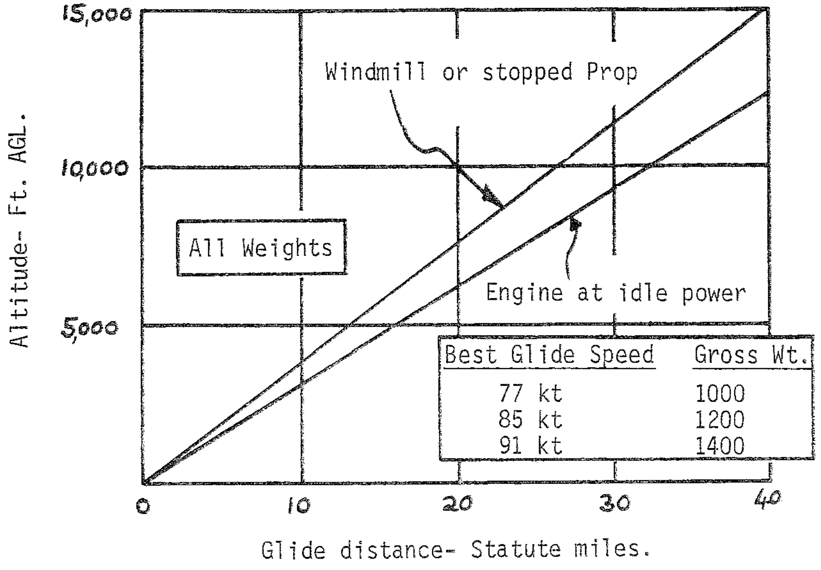
Cruise segment range-nautical miles peak EGT mixture.

Ⓐ Full throttle at 8000 ft - 75% power max cruise 143 kt indicated, 161 kt true, and 6.7 gal/hr

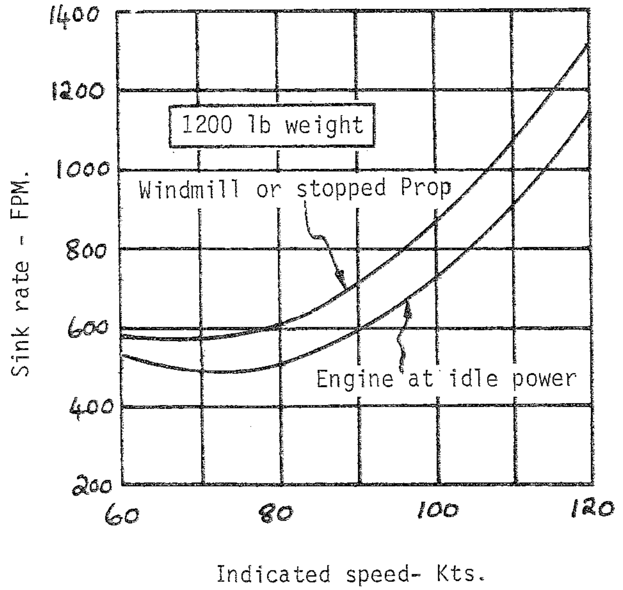
Ⓑ Full throttle at 12,500 ft - 60% power 122 kt indicated, 148 kt true, 4.9 gal/hr

Ⓒ Partial throttle at 12,500 ft - 40% power economy cruise, 105 kt indicated, 127 kt true, 3.4 gal/hr.

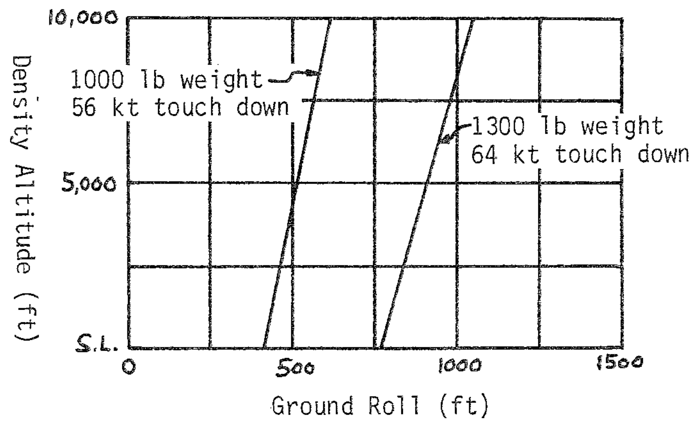
Glide - Gear up

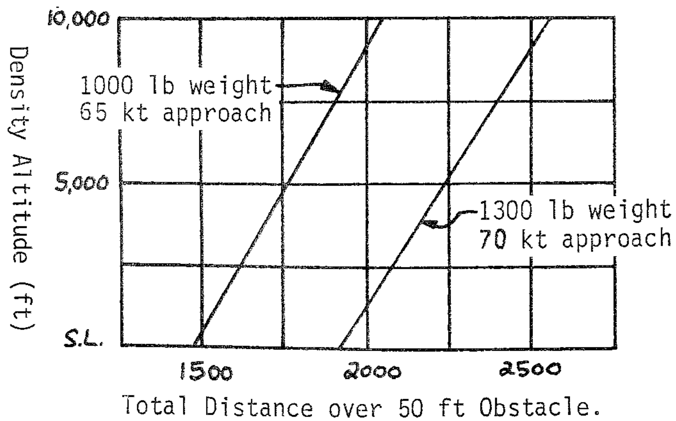


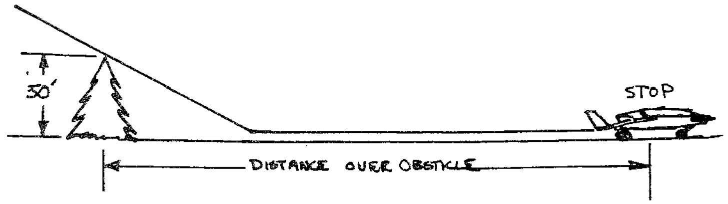
Sink rate- sea level- gear up.



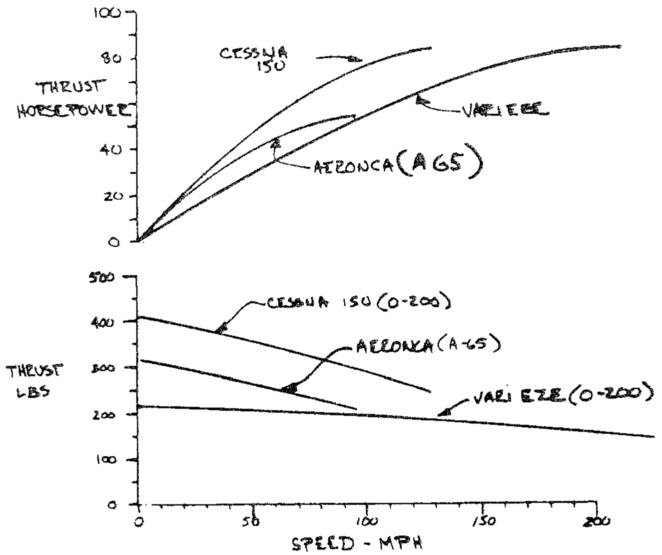
LANDING DISTANCE - LANDING BRAKE EXTENDED







Pusher Engines: As you engine experts know, the Continental 0-200 (100 hp), 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 Long-EZ. 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 crank shafts are almost identical (not interchangeable) and the A65 engine is approved as a pusher without modification. Because of the fixed-pitch prop, designed for 185 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.



Pusher Installation of Continental Engines.

VariEze prototype N4EZ now has 480-hour flying time with the 0-200 A Continental engine. No measuarable end-play wear has occurred. Absolutely no problems have been encountered with the unmodified 0-200A engine.

LONG-EZ AIRWORTHINESS DIRECTIVES

Number	Description	Date complied with
001-80	Continental 0-200 engine starter bearing keeper. Ref C.P. 23, Long-EZ plans page 23-1	

EQUIPMENT LIST

This list should consist of all those items of equipment installed in the aircraft that determine the aircraft empty weight. This list should be complete to include as applicable: engine, prop, spinner, wheel pants, each instrument, radios, seat cushions, headset, intercom, battery, tie downs, canopy cleaner, lights, ballast etc., etc. Be very complete with this list and keep it up to date. Every item outside of basic air frame structure should be on this list. Use this list to correct and update the weight and balance. Weigh each item and use the back cover of the plans to determine fuselage station for moment.

Long-EZ Serial No.________ Registration No._______ Date _______

Paint type ________________ Color _____________ No.__________

Trim type _________________ Color _____________ No.__________

Interior type ______________ Color _____________ No.__________

Status of Equipment - X Installed
O Removed.

Status	Item	Weight	Arm	Moment
Engine				
Prop				

LONG-EZ CHECK LIST

Exterior Preflight Inspection

Cocktpit

Mag Switches - Off
Master Switch - On,check Battery condition and warning systems
Master Switch - Off
Mixture - Idle cutoff
Throttle - Idle
Cockpit access door - Closed,key removed
Flight control Lock - Removed
Stick - Free and unobstructed foward and rear cockpit.
Rudder Pedal Area - Clear of loose items, balast not required removed.
Rudder cable / Quick Disconnect - Secure
Pitch Trim - Check operation and cable connected.
Fuel Selector - ON (left or right)

Canard Nose Section

Elevator - Condition,hinges, Balance weights secure
Elevator - Free
Static Ports - Unobstructed
Pitot Tube - clear undamaged
Nose Parking Bumper - Check condition

Right fuselage/Wing

Canopy Hinge - undamaged
Fuel Quantity - Visually check
Fuel Cap O-ring - Condition
Fuel Cap - secure check alignment marks.
Fuel Tank Vents - Clear
Fuel Tank Drain - Check free of water/sediment
Fuel - Proper color (red 80, Blue 10011, Green 100.130)
Wing and Vertical Fin - Condition
Tie Down - Removed
Rudder - Free, cable/Hinges secure, drain hole open.
Rudder return Sprin - Secure, returns to neutral
Nav Light - Secure.
Aileron - Free hinges, secure

Aft Fuselage - Engine

Main Gear Strut - Secure
Brakes - Check for wear
Tires - Check wear and inflation
Cooling/Carbinlet - Clear
Drain Gascolator - Check free of water sediment
Gascolator Drain Valve - Check for complete shut off
Cowling - Check condition - all fasterners secure
Propellor - Check for nicks, cracks, erosion
Spinner - Check for cracks, screws secure
Exhaust Tubes - Check for security
Engine Area - General condition, baffles, loose items.
Oil Level - Check, dip stick and door secure

Left Wing Fuselage

Same as Right.

Nose Gear/Landing Brake

Perform fuel tank and gascolator drains prior to lifting nose.

Lift nose. Extend gear and landing brake. (Hold nose down during this check).
Strut/Pivot - Secure, undamaged.
Wheel Friction Damper - Adjusted (2-4 lbs force to swivel).
Wheel well/Door - Secure
Tire - Check wear/inflation
Landing Brake - Check for damage, hinge/push rod secure
Landing Brake - Retract
Nose Gear - Retract for hand starting.

Engine Start - (with electric starter)

Lift nose, extend and lock nose gear, board aircraft and hold brakes.
Mixture rich / carb heat cold
Throttle - Prime and crack
Master Switch - ON
Auxilary Fuel Pump - On to check pressure (4-8 psi)
Auxilary Fuel Pump - OFF
Propeller - Clear (Holler loud, wait for response, have outside observer confirm area clear).
Mag Switches- On (Lycoming left mag only for start)
Start Engine - Check both mags on - Oil Pressure

Engine Start - (Hand Propping)

Park on nose bumper
Mixture rich / carb heat on
Throttle - Prime and crack
Master Switch - On
Auxilary fuel Pump - On to check pressure (5-8 psi)
Auxilary Fuel Pump - OFF
Pull prop through 8 blades (mags cold)
Mag/s On (Lycoming start left mag only)
Hand-Prop engine
After start - check both mags on and oil pressure
Throttle - idle and chock in necessary
Hold nose down and board aircraft.

Before Taxi

Correct pilot position - rudders adjusted, seat cushions to place head within 1" of canopy top.
Seat belts and shoulder harness - adjusted / locked
Radio / Avionics lights - On, as required

Before Takeoff

Emergency Canopy access door - closed / locked
Fuel Caps - Locked, check alignment marks.
Fuel Selector - Fullest Tank
Controls - free and correct
Trim - Set for takeoff
Landing Brake - Up
Circuit breakers - In
Gen/Alt - On
Lights - as required
Flight instruments - Set (alt, D.G., Attitude ind., clock)
Auxilary Fuel Pump - ON
Engine Run Up - (List specfic engine limitations)
- Mags
- Carb Heat
- Oil Pressure
- Fuel Pressure
- Gen/Alt out put
- Mixture - set as required
- Static RPM - 2450 min.

Canopy - Locked - visually confirm proper latch and safety engagement

Climb/Cruise

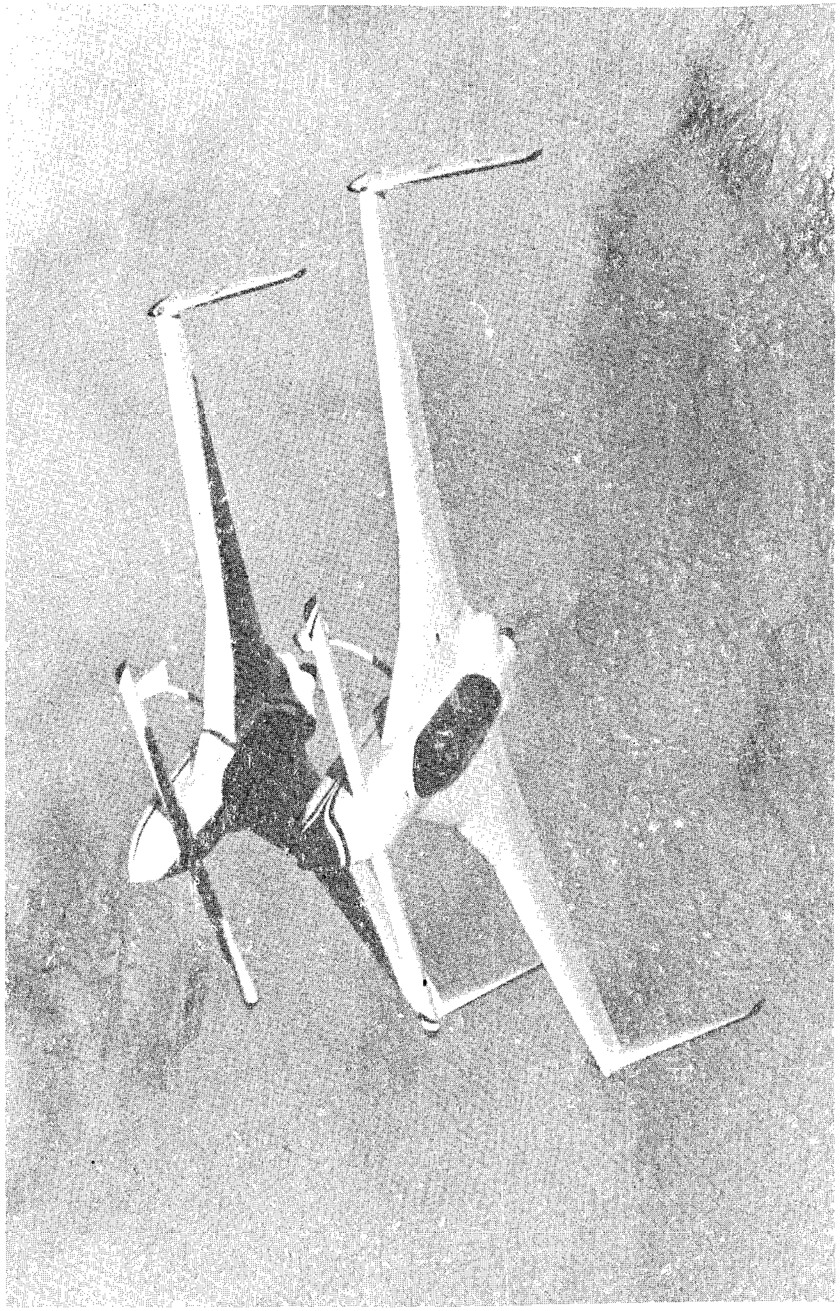
Gear - Up
Boost Pump - OFF (above 1000 ft AGL)
Lean Mixture - as required
Fuel Selector - Balance management

Descent/Landing

Circuit Breakers - In
Fuel - Fullest tank
Mixture - Rich as required
Carb Heat - On as required
Boost Pump - On below 1000 ft AGL
Gear - Down below 110 knots
Landing Brake - On as required

After Landing/ Shut Down

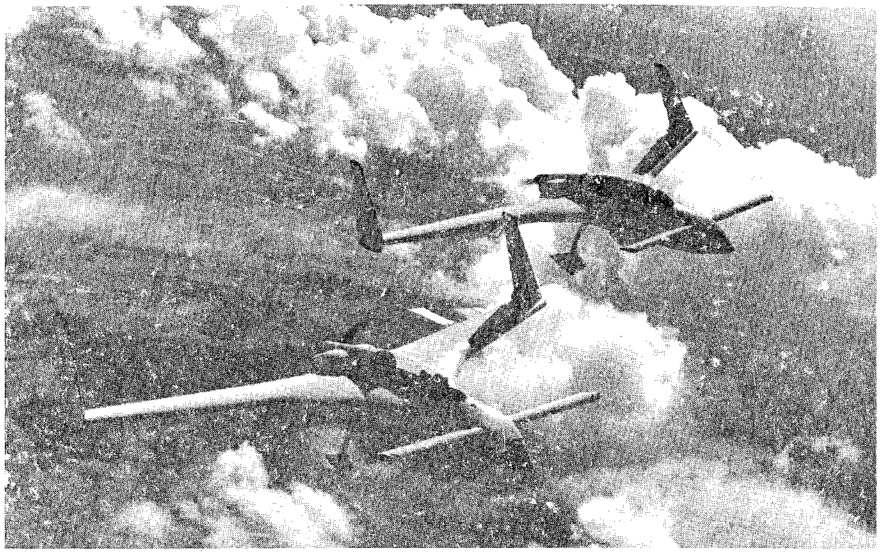
Boost Pump - Off
Carb Heat - Off
Landing Brake - Up (After fast taxi speed)
Lights - Off as required (landing, Nav, strobe, cockpit)
Electrical Equipment - Off (radios, nav)
Mixture - Idle cut off
Mags - Off
Master Swich - Off
Deplane, hold nose, retract nose gear, lower nose.
Secure aircraft, canopy, controls, tie downs.

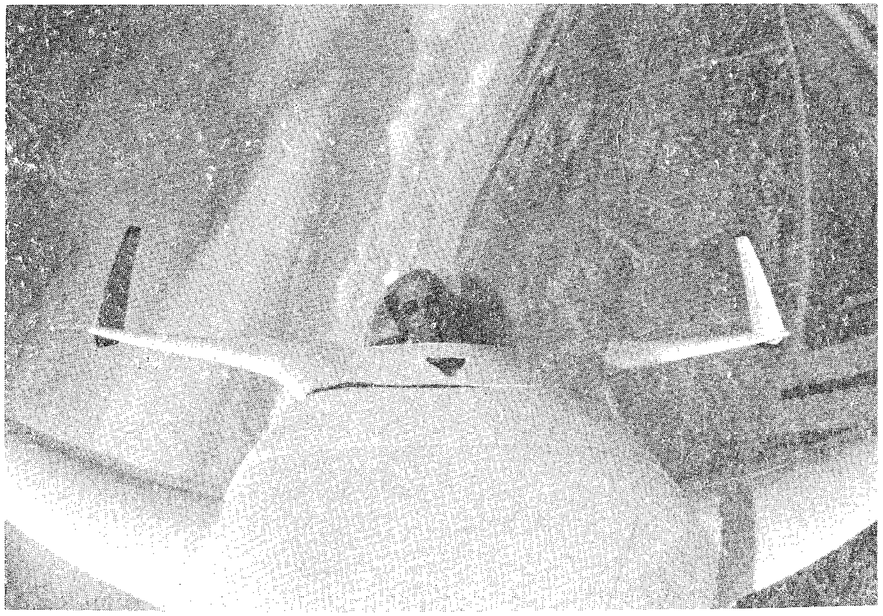


Long - EZ

OWNER'S MANUAL

Second Edition — October 1981





Published by

Rutan Aircraft Factory, Inc.

Building 13, Airport