REGISTRATION NUMBER

BUILT BY

ADDRESS

DATE OF MANUFACTURE

ENGINE MANUFACTURE TYPE

SERIAL NUMBER

TOTAL / SMOH HOURS AT INSTALLATION

DATE OF FIRST FLIGHT

SOLD TO

ADDRESS

DATE OF SALE

NOTES

CONTENTS

NOTE

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

WARNING

THIS MANUAL IS UPDATED THRU CANARD PUSHER NEWSLETTER #82 UPDATES.

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 O-200 (100 hp) and the Lycoming O-235 (115 hp). It has an alternator powered electrical system and can be equipped with an electric engine starter. It's cockpit layout is designed to compliment pilot work load with throttle, mixture, carb heat, pitch trim and landing controls on the left side console and a side stick controller on the right console. Seating provides correct armrest, lumbar, thigh and headrest support allowing "recliner chair" comfort not found in conventional aircraft seats. This allows long, fatigue free flights. The inboard portion of the large wing strakes are used as baggage areas accessible from the front and rear cockpit. These, combined with special suitcases and three other storage areas, provide nearly 10 cubic feet of baggage room.

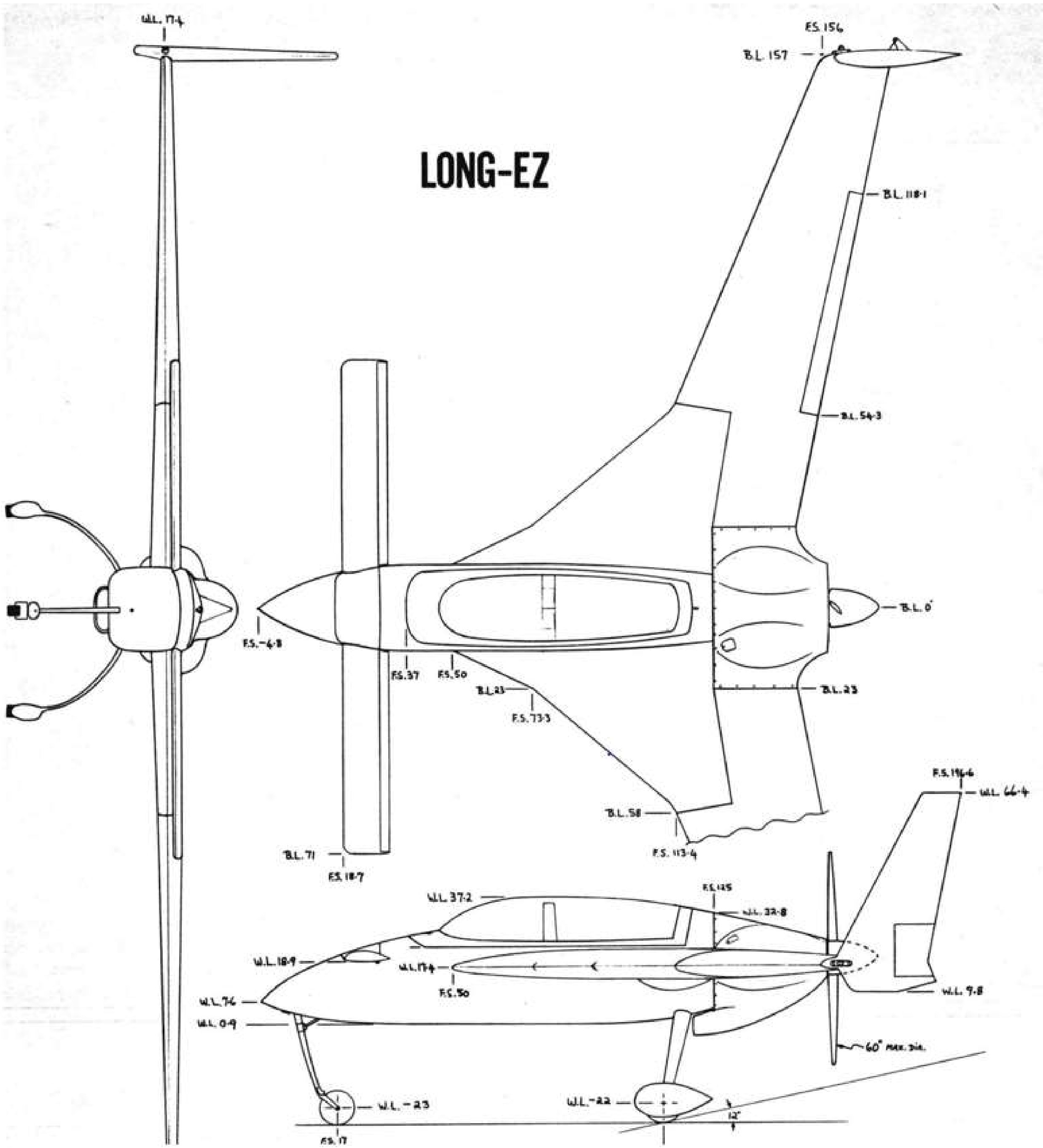
The Long-Ez aircraft pioneers the use of the NASA developed winglet system which consists of an upper and lower cambered surface at each wing tip. These are designed to offset the wingtip vortex and reduce induced drag. The Long-Ez use of one way rudders in each winglet, makes use of the winglet camber 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 operation from unprepared surfaces, gravel, loose dirt or rough fields.

DIMENSIONS

Wing Span/area	26.1 ft	7.9 m	81.99 sq ft	7.52 sq m
Canard Span/Area	11.8 ft	3.6 m	12.8 sq ft	1.19 sq m
Total wing area	94.8 sq ft	8.81 sq m		
Length	201.4 in	5.12 m		
Height	94.5 in	2.4 m		
Cockpit Width	Front	23 in	0.58 m	
	Rear	21 in	0.53 m	
Cockpit Height	Front	36 in	.91 m	
	Rear	35 in	.89 m	
Cockpit Length	Front	70 in	1.78 m	
	Rear	54 in	1.37 m	



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 on each side. The airplane can structurally accommodate 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. See weight and balance section on page 25.

NOTE

A gross weight of up 1425 lbs can be allowed for takeoff but only under certain conditions. See weight and balance section of the 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 may be 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 approximately one half the cost of a new one. A partially run-out engine is generally preferred 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-235R (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 propellers are approved. Turbo charging and constant speed, variable pitch or metal propellers 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. Maximum speed is fastest with the climb prop, but the engine turns faster than rated RPM at max speed.

Prop	Engine	Prop Disc and Pitch	Prop Efficiency cruise	Prop Efficiency Climb
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 about 95% of rater 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 purpose, this over-speed condition is not detrimental to the engine when operation at less than 75% power (above 8000 ft at full throttle.) The over-speed at max cruise can be eliminated by selecting a cruise prop, however takeoff performance and climb is affected by as much as 25%.

NOTE

All of 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 reference, add about six inches to the above pitch values. Some variance in pitch 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 landings. 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 nose gear 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 for easy entry for the backseat passenger. Nose gear position is displayed to the pilot through a Plexiglass window through which he views the nose gear 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 inches in diameter and uses a 2.800-2.50-4 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 provide for optimum crew comfort. Pilots up to 6 ft 6 in tall and 220 lbs, and passengers up to 6 ft 3 in tall and 220 lbs, will find the cockpit quite comfortable. Pilots 6 ft 3 in 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 allow for a full length rear cockpit without the passenger having to straddle the pilot.

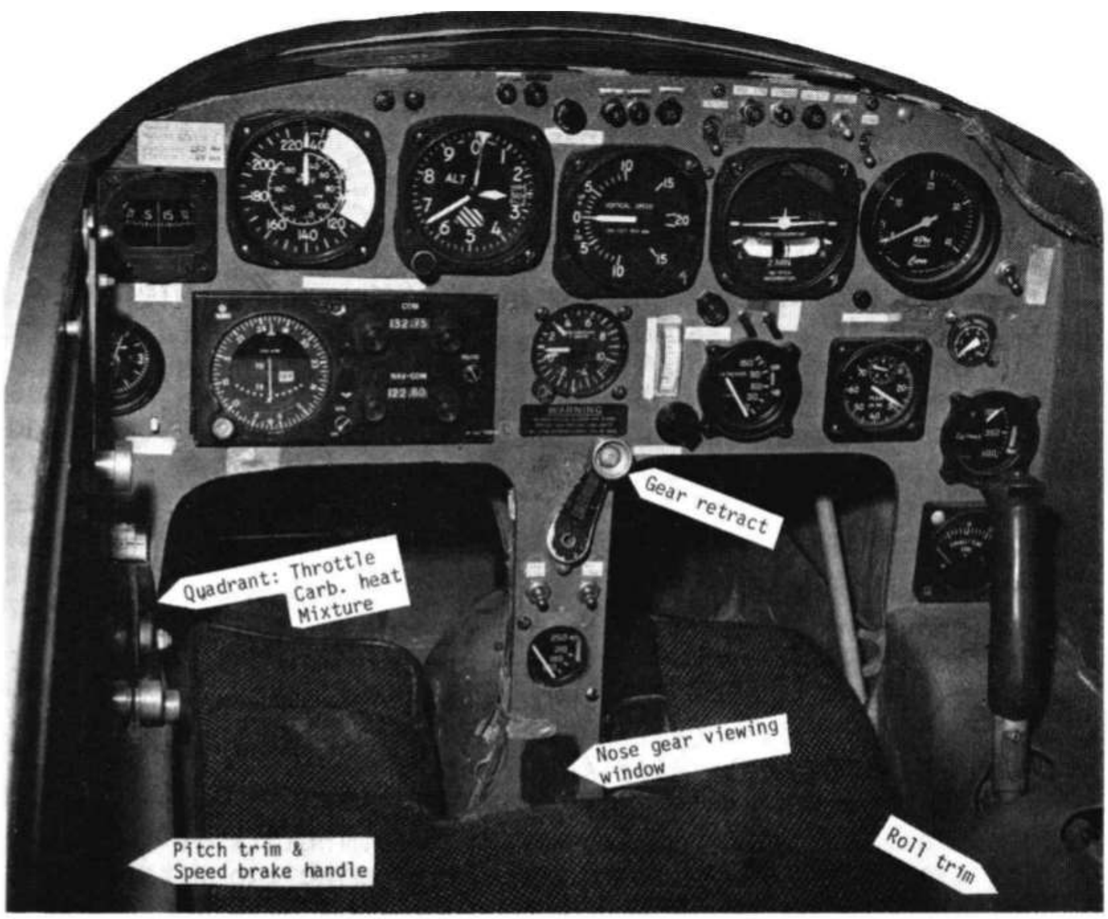
Full flight controls are provided in the front cockpit only. The wrists action control stick is positioned on the right side console enabling the pilot to relax and rest the weight of their arm on the side console, reducing their work load on long trips. Throttle, carburetor heat and mixture controls are found on the left 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 the passenger to land if the pilot become incapacitated. The rear stick is removable to allow increased baggage room The rear seat does not have rudder pedals due to the awkward poot position of the rear seat occupant. Also the airplane is not intended for, nor recommended for flight training.

The inboard portion of the large strakes are used as baggage areas accessible 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 / rollover 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, in sunny conditions). Thus the requirement for cabin heat is far less than for conventional light planes. Due to the small cabin volume and good vent location the Long-Ez is more comfortable on hot days than conventional light planes.

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 backup, to catch the canopy if the pilot forgets to lock it for takeoff.



FUEL SYSTEM

The fuel system consists of two 28 gallon, individually selected, wing tanks. A three way selector (left, right and off) is located in the thigh support center, just aft of the nose wheel position window. There is no provision for cross feed nor can fuel be used in both tanks simultaneously. Two fuel sump blisters located under each fuel tank at the fuselage junction assure fuel supply to the engine in 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 delivers fuel from the tanks to the carburetor. An auxiliary electric fuel pump provides backup for the engine driven pump. Fuel pressure is indicated on a gage 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 any 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 gas-collator mounted on the firewall. The gas-collator is easily accessible through the air scoop under the cowling for draining during pre-flight. To prevent overfilling the fuel tanks, exceeding the gross weight limitations for two place, the tanks cannot be completely with the nose down parking. To fill the tanks to the full 52 gallon capacity, the nose wheel must be extended to level the aircraft. Be careful 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 through the vents. Filling to full capacity should be done only when required for single place, extended range trips.

CAUTION

Fuel additives should be checked for compatibility 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 dissolve 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 in the winglets at the wing tips, operate outboard only, providing two totally independent systems. The rudders are used simply 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 the 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 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 teather that the pilot can pull in after reaching the brakes.

TRIM SYSTEMS

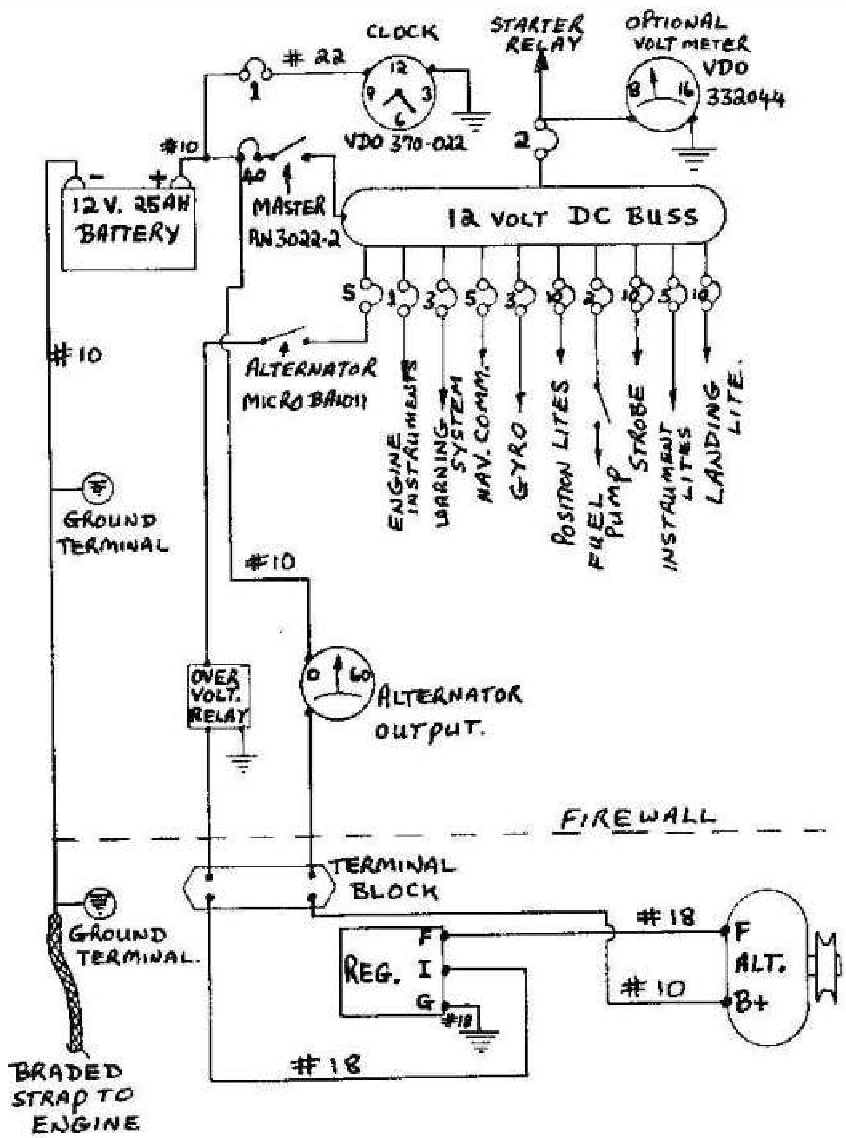
Cockpit adjustable trim is provided for pitch and roll only. Yaw / Rudder trim is ground adjustable only. Pitch and roll trim tabs are not used. The pitch trim handle is located on the left console inboard of the landing brake handle. The aileron trim handle is located on the right console. The pilot can safely override any trim setting even if it is 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 AIR-BRAKE

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 air-brake down is 90 knots (105 mph). 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 they forget it on his take-off checklist. Climbs should be avoided with the 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 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.



NORMAL OPERATIONS

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

PILOT POSITION

The Long-EZ was designed to accommodate tall pilots up to 6’ 8”. Short pilots can fly the aircraft but they must sit on cushions to position their eyes in about the same position as the 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 under them, not behind them. If a short pilot uses a large cushion behind them, they will be positioned forward and down because of the windshield slant angle and have inadequate visibility during climb and landing flare. Confirm that your head is within 1 inch of touching the canopy before you take off.

ENGINE START

Engine starting may be accomplished by hand propping. While you have doubtlessly been horrified by the accident statistics on hard-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. The Long-EZ 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, impulse coupled magnetos, it is not necessary (or desirable) to make Herculean pull of the propeller for starting. Just pull the engine up to compression and give it an Long-EZ flip through. In the unlikely event it does run away from you after starting (if yo leave the throttle open) it won’t carve the first thing it comes into hamburger, but will givit 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 carburetor has an accelerator pump for automatic priming. Starting can be difficult without one. Even though the Long-EZ is much less susceptible to run away during hand propping, it is still good practice to have someone tend the throttle and switches during starting. Some engines have only one magneto equipped with an impulse. Be sure the non-impulse magneto is off for starting. If you Long-EZ is starter equipped, use special care that the prop is clear before starting. Yell loudly and wait for a response or time for the person to get out of the way. Have an outside observer confirm that the prop area is clear prior to starting.

COLD START

1. Pump throttle once or twice
2. Mag(s) OFF
3. Pull engine through four blades

4. Mag(s) ON
5. Grab prop about 1 ft from tip, pull down onto compression and give a smooth flip
6. Repeat as necessary. If the engine does not start after five or six pulls, see flooded start procedure or very cold conditions procedure.

HOT START

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

FLOODED START

- Mag(s) OFF
- Throttle OPEN or HALF OPEN
- Turn prop BACKWARDS about 10 blades to clear manifold
- Throttle - 0.5 inch from closed
- Mag(s) ON

A flooded engine will start easier if cranked with the throttle about half open. Do this only if you have someone standing by with their 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 the engine hard to start
- Pump handle four times
- Mag(s) OFF
- Pull prop through four blades
- Mag(s) ON
- Pull prop through gently
- When feasible, engine preheated or use of an oil dipstick heater is desirable.

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

TAXING

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 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 nose wheel crank with any weight on the gear.

CAUTION

Keep taxi speed slow on unprepared and / or loose surfaces. The Long-EZ is more susceptible to prop damage than a conventional aircraft.

Steering below 25 knots (30 mph) is accomplished 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 yo 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 accomplished through differential braking. The geometry of the Long-EZ makes it much less sensitive to upset than most aircraft. Comfortable taxing operations have been demonstrated in 40 knot crosswind components. Be careful to hold the stick while taxing downwind so that the "tailwind" won't damage the ailerons.

CAUTION

When taxing with the canopy open, be careful that the wind does not slam it closed on your fingers. Close and lock the canopy during windy conditions.

TAKEOFF

Complete the pre-takeoff 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 noses 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 an angle that places the canard on the horizon.

CROSSWIND TAKEOFF

During takeoff ground roll with a crosswind component greater than 10 knots you will find that wheel braking may be required long into the ground roll for directional control. The best technique is to hold full rudder but not to ride the brake continuously. Apply brake intermittently 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 a crosswind component of 15 knots. Landing can be made with a crosswind component of up to 20 knots.

CROSSWIND TAKEOFF TECHNIQUE

Hold aileron into the wind as you rotate for liftoff. Let the aircraft accelerate above normal rotation speed and then rotate the nose abruptly to make a clean liftoff without side-skip. For crosswind components above 10 knot, 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 the 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 the brakes and try to use minimum braking for directional control. Rotate to lift-off at 56 knots (light weight) or 65 knots (heavy). Maintain best angle of climb speed (70 knots or 80 mph) until the obstacle is cleared then accelerate to normal climb speed. See page 55 for distances.

ROUGH FIELD CAUTION

Although the Long-EZ may use the larger 500x5 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 aircraft.

If you must use an unprepared surface, reduce gross weight as much as feasible and adjust the CG as far aft as practical (within safe 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 rises, 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 then accelerate to the desired climb speed. Don’t try to “jerk” the aircraft off prematurely as 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 further aft and up. The shock strut along with the larger 500 x 5 main tires will provide satisfactory operation from most grass fields and will allow operation from rough fields. Because of the likelihood of prop damage. avoid gravel or loose rocks.

HIGH DENSITY ALTITUDE

At density altitudes about 5000 ft, follow the normal takeoff procedures and:

1. Lean the engine for best power during run-up

2. Let the aircraft accelerate to 65-70 knots (70-80 mph), then smoothly rotate and lift off.

CLIMB

Climb performance data is given on page 56 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 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, 1979.

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 5000 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. To take the best advantage of range and fuel economy, you may find that a cruise power setting as low as 45% will get you to your destination faster by avoiding fuel stops. Cruise at 50% power is the best compromise, providing good speed and significant lowering the 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 EGT setting for optimum lean mixture. Note that the best range is obtained at a very low speed (page 60.)

A good rule of thumb for choosing an economical cruise power setting, is to cruise at the same RPM that you get during 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 contaminants exist 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 can verify that you can select and use the fuel in the other tank.

Once at cruise altitude (in smooth air), trim the aircraft to allow for hands-off cruise. It is much less fatiguing to fly by using an occasional shift of body weight or an occasional small adjustment to the trim, than to fly by continuously holding the stick. After a little practice setting trims, you will find you will be doing most of (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 an outstretched position in front of the rudder pedals. This places the weight of the thigh on the thigh support rather than his tailbone and greatly increases control on long flights.

The Continental engines are particularly susceptible to carburetor ice. Icing can occur during cruise in most air, particularly at low cruise power settings. When in mT

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 owners report nose up and some nose down. This phenomenon is not fully understood and your aircraft may react differently. Our flight tests on the prototype Long=EZ have found a slight performance loss and this 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 visible moisture conditions, it can be re-trimmed and flown normally. There may be a slight 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 cruise altitudes to avoid turbulence discomfort more often that with most light aircraft. It is not unusual (nor inefficient) to climb to 12,000 ft altitude for a 150 mile trip. Bearing this in mind, you wan to plan you 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 enrich mixture when descending. Start your descent about 6 miles from your destination for every 1000 feet of height to lose, in order 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 to 15 knots fast on your approach. Failure to use the landing brake will result in a flat wide pattern, more difficulty airspeed control and the probability of overshooting your desired touchdown point. Make a complete flare and touch down at 55 knots (63 mph.) The normal landing technique of holding the nose off to minimum speed should not be used in a Long-EZ. Make a complete flare, then fly it down to touch down. This avoids the common tendency to flare too high. While full-stall landings are easily done with some practice, it is better to land a bit faster 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 the nose wheel during heavy braking. While the landing gear is strong enough for rough surfaces, the small tire diameters give the crew a harsh ride. This combined with 50-55 knot (57 – 63 mph) touch down speed, make a hard surfaced runway much more pleasant. If you need to land on a rough field, hold the aircraft off to a minimum speed and keep the nose high as long as possible.

CAUTION

Never flare beyond the angle that places the canard on the horizon.

Crosswind landings may be flown in several ways. Mild crosswinds are easily handled using the wing-low side-slip approach. 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 rudder immediately before touch down. Be careful that you do not lock the wheel brake (full rudder) at touch down. The Long-Ez has a demonstrated taxi, takeoff and landings in gusty winds to 45 knots and with a crosswind component 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:

1. With landing brake – 1800 ft

2. Without landing brake – 2400 ft

LANDING GEAR SPEEDS

Don’t extend the {nose} gear above 120 knots (138 mph.) At higher speeds the air loads 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 roll-out, placing the CG aft of the main wheels. Avoid rotation above 12 degrees (canard on the horizon) using forward stick or brakes if necessary, to avoid prop damage or tipping the aircraft onto it’s tail.

CAUTION

If the nose gear mechanism is not lubricated or is binding it may be difficult to crank down the gear. If this occurs, do not force the handle. Slow down to minimum speed if necessary to allow it to crank down easily. Fix the cause of the binding before conducting any further flights.

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 it's nose wheel but may tip backwards when the fuel bleeds through the baffles toward the aft 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 people who are unaware of this trait, ballast the nose or attach a sign to caution them about the possibility of tipping over backward.

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 possibility of gear creep and loss of alignment.

GROUND HANDLING AND TIE DOWN

The easiest 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 it's nose bumper, in moderate winds. It is prudent to always tie down and 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 removable 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 weigh the nose with ballast. Be sure to remove the additional ballast 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 it's minimum airspeed of 50 to 55 knots. It doesn't exhibit any of the conventional airplane's tendencies to roll, pitch down uncontrollably or other common unintended flight path excursions. Any power setting may be 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 rang (below 58 knots) is characterized by doubling of force required to hold 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 aft stick force, such that a 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 consisting of 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 unexpected “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 an 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 affecting the stall characteristics. There is a small roll trim change due to power and <u>very slight</u> pitch trim change, neither of which affect the aircraft’s control ability at sustained full aft stick.

Accelerated stalls to =3 g and steep pull-ups to 60° pitch (min speed 55 knots) can be done at full aft stick without any departure tendency.

Intentional spins have been <u>attempted</u> by holding full aft stick and using full rudder, with all combinations of aileron control, and all CG positions. These controls were held through 360 degrees of rotation. Full aft stick and full pull-up 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 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 aft CG, the rotation rate is higher so the lazy spiral is more of a slow snap roll. Even at aft CG, the recovery is immediate when controls are neutralized.

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

<u>NOTE</u>

Experience with VariEze has shown that some variance in stall characteristics may be expected from one airplane to another. Inaccurate airfoil shapes, incidence errors, or errors in weights and balance can result in degradation of the normal safe stall characteristics. Aft of the aft CG limit, the Long-EZ may become susceptible to aft wing stall which, can result in a stall break with high sink rate. If any of your aft-cg characteristics are undesirable, 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 a fire, on the ground, kill all electrical power and shut the fuel off. Clear the aircraft. Use the dry type extinguisher. For in-flight fire, determine the cause.:

1. If electrical – all electrical power offering
2. If fuel – fuel off, electrical power off, cabin heat off, cabin air vent on.

For fire on the ground during start:

1. Fuel off, electrical power off.
2. Exit aircraft, use the dry type extinguisher to fight the fire.

A fire during start is normally started by the pilot over priming the engine, by cycling the throttle several times causing the carburetors throttle pump to pump too much fuel into the intake manifold. The lowest point of the intake manifold, before it connects to the carburetor, should contain a small hole leading to a tube thru which the excess fuel can drain down thru the cowl and onto the ramp. Pilots should note that fuel injected engines do not normally need to be primed due to the presence of an electrically operated boost pump.

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.) On the other hand, pilot induced failures are far more common such as carburetor ice, confusion of Carb heat and mixture controls, fuel starvation, fuel management, etc. In the event of an in-flight engine stoppage:

1. Mixture – Rich
2. Fuel – switch tanks
3. Fuel pump – On
4. Magnetos – Both on
5. … the attempt to restart.

If the engine begins to run rough, check for induction icing, improper mixture setting or a bad magneto. If carburetor 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 occur and restart is impossible, execute the engine out approach and landing.

In case of engine failure, the engine will probably windmill above 70 knots. As the engine cools down a higher speed may be required to maintain engine rotation. With some engines / props a glide speed as high as 100 knots may be 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 may be 180 knots (4000 ft altitude loss) for the high compression O-235-F. The pilot should determine when it is no longer feasible to attempt a restart since the best glide angle speeds (page 61) may be lower than windmill speeds. Best glide distances may be executed with the 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 detailed on page 61. Remember that the engine out and prop wind milling, your glide will be considerably steeper than normal engine-idle glide that you are accustomed to. If you are radio equipped, tune to 121.5 MHz and declare and 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 patter with the landing brake out and shoot for the middle 1/3 of the forced landing area. Therefore if you miss judge short, you can retract the landing brake and possibly make the field. Turn your electrical power and mags off before touchdown to minimize any potential fire hazard. Touch down as slowly as possible if landing in rough terrain.

INFLIGHT CANOPY OPENING

Canopy opening in flight is a serious emergency. With the canopy unlatched warning system and the safety catch, the likelihood of a canopy open in flight is remote. 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 immediately 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 fuselage with the fingers.

Remember to maintain aircraft control. Do not be so concerned with closing the canopy that you allow the aircraft to fly unnecessarily 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 if 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 hole 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

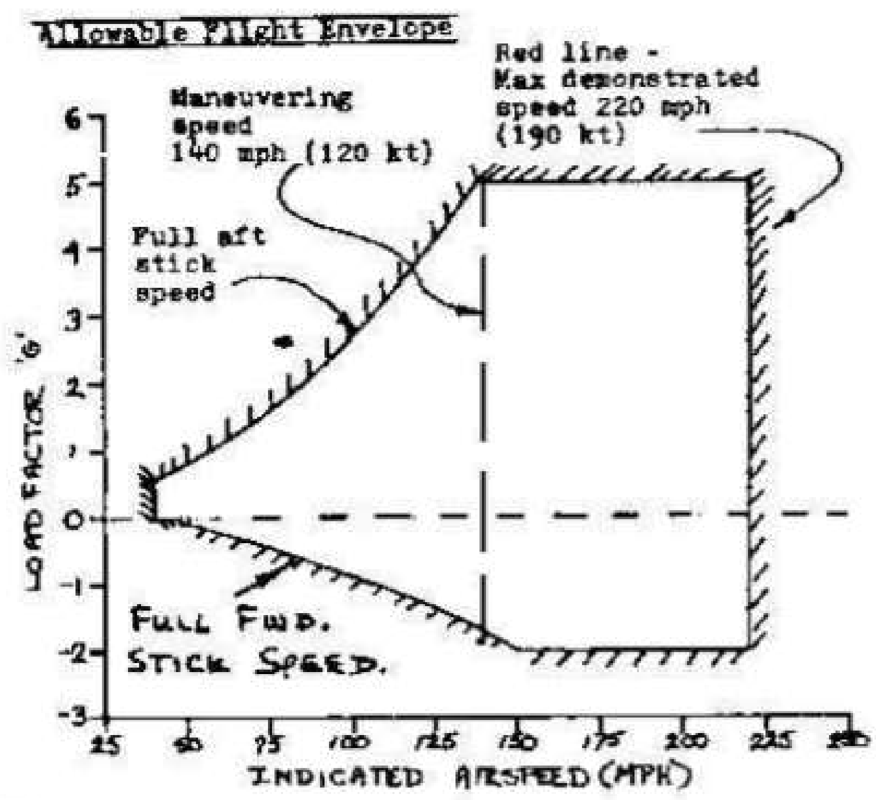
Since the brakes are the only means of directional control after the aircraft decelerates below about 35 knots, landing with a brake out poses a special kind of problem. The risk of damage can be minimized by considering the following: if possible, select a long runway with a cross wind from the side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

If it becomes obvious that the aircraft will leave the runway and enter rough terrain 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. This may be preferable to running into an obstacle.

The Long-EZ prototype (N79RA) was successfully landed in calm wind with no damage after suffering a complete failure of 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 wing-let 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, visible to the pilot.

Solo – Front seat only

Min Pilot weight xxxx lb.

Max Pilot weight xxxx lb.

Max gear extension speed, 130 knots (138 mph)

Max speed with gear down 150 knots (172 mph)

No aerobatic maneuvers are app[roved except those listed below:

Maneuver	Recommended Entry Speed*
Candeles	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 (120 mph)

Abrupt use of controls is prohibited above 120 knots

Max Crosswind component – 15 knots takeoff, 20 knots landing
Intentional spins are not permitted
Maximum wind for taxi (all quarters) – 40 knots (46 mph) w/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 lbs
Center Gravity limits – fwd 97.0 – aft 103.0

ENGINE LIMITATIONS*

	Lycoming O-235	**Continental O-200**
RPM	2800 Max	2750 Max
CHT	500° F Max	525° F Max
	435° F Continuous	440° F Continuous
Oil Temp	245° F Max	225° F Max
	180° F Desired	150 0 200° Desired
	170° F Min Continuous	
Oil pressure	60–90 PSI Normal	30-60 PSI Normal
	25 PSI Idling	10 PSI Idling
Fuel	Series C & E 80 Octane	80 Octane
	Series F, L & G 100 octane	

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

Add the following placard to the Cockpit:

WARNING! -- STATISTICS INDICATE THAT AMATEUR BUILT AIRCRAFT ARE MORE LIKELY TO HAVE AN ACCIDENT, INCLUDING A FATAL ACCIDENT, THAN FAA CERTIFICATED, MANUFACTURED TYPES. WHILE STRICT ADHERENCE TO OPERATING PROCEDURES CAN REDUCE THIS RISK, THE HAZARDS ARE SIGNIFICANT, PARTICULARLY DURING INITIAL FLIGHT TESTING OR WHEN OPERATED IN A NON CONSERVATIVE MANNER.

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. They should be current in more than one type of airplane. The Long-EZ is not difficult to fly but it is different in much the same way as a Yankee is different from a Cessna or a Cub is different from a Cherokee. A pilot who is used to differences between a Cessna and a Cub is ready for the differences in a Long-EZ. The Long-EZ has entirely conventional flying qualities. It’s responsiveness is quicker and it’s 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 tendency of the tail-draggers.

The requirement for a variety of experience applies to checkout in any new aircraft, not only to Long-EZ. RAF has never experienced a problem in checking out a Long-EZ pilot. As of this writing 32 pilots have been checked in the Long-EZ 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 a runway of at least 3500 ft. in length 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 firsthand look at the aircraft’s performance envelope and general flying qualities. Trim the airplane up and let them “fly” it from the back seat by leaning back and forth. This will give him an appreciation of the airplane’s natural stability. Show them the use of the trim systems (pitch and roll.) Let them get used to the pitch and roll feel by flying the rear stick control. Do not transition him to the front seat unless he flies the aircraft smoothly and confidently from the rear seat.

4. Have them 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 28).**

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 types of aircraft in the last 4 months (5 of which in the last 30 days) and feel competent and comfortable in them doing 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 and then re-establish a normal climb. We have found that this is caused by an 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 they have 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 lift off at 65 knots. If you think you have over-rotated, do not overact, i.e. 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 them 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 the flight test procedures in Appendix II (page 38.)

WEIGHT AND BALANCE

Loading data and sample problems are shown below. Be sure you use empty weight and moment data for your aircraft as was 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 a calculator) with the weight vs fuselage station chart.

Add up the weight and moment totals of your load as shown in the sample problems, then divide the total moment by total weight to get the CG position fuselage station in inches aft of the datum (F.S.0.0.) For the light pilot sample, the total weight is 1,113 lb, total moment is 115706 inch pounds and the loaded CG (115706/11133) is 103.96 inches at F.S. 0.0. The chart shows this weight and CG position to be outside the acceptable flight envelope (C.G. aft limit of 103) as shown on page **28**.

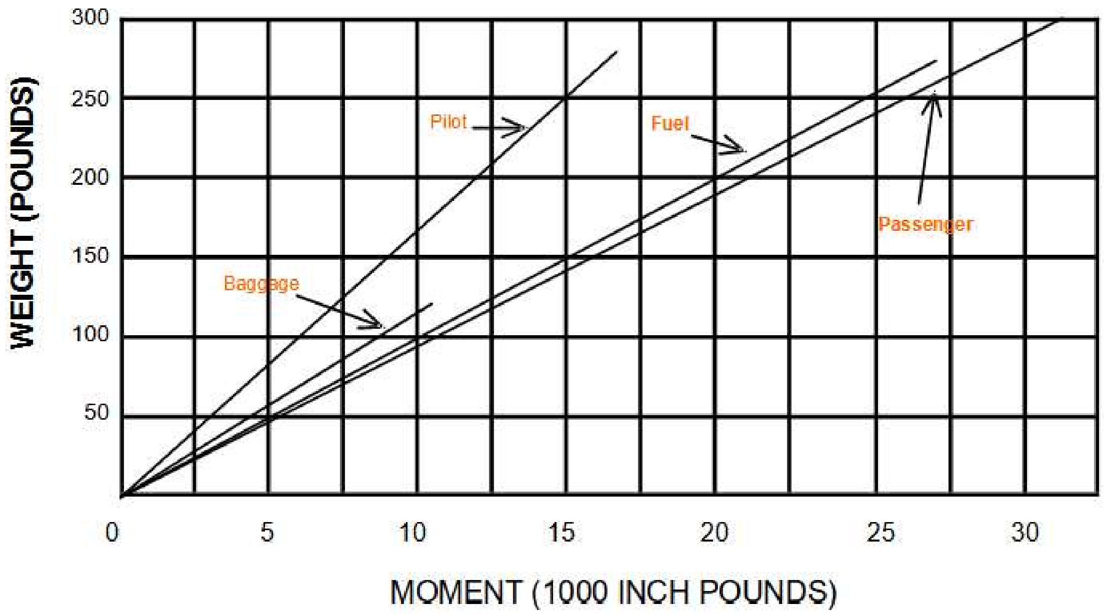
$$\text{CG Position FS} = \frac{\text{Empty Moment} + \text{Pilot Moment} + \text{Passenger Moment} + \text{Fuel Moment}}{\text{Total Weight}}$$

Where:
Empty moment is determined by weighing (see page 33.)
Pilot moment = Pilot weight times 59
Passenger Moment = Passenger weight times 103
Fuel Moment = fuel gallons times 6.0
Total weight = empty weight (page 36) + pilot + passenger + fuel

SAMPLE LOADINGS

	Light Pilot			Heavy Pilot		
Item	Weight	Station	Moment	Weight	Station	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	7865	210	59.0	12390
Passenger		103.0		210	103.0	21630
Baggage		90		15	90.0	1350
Total	1113	103.96	115708	1323	101.06	122706



YOUR AIRPLANE

Item	Weight	Station	Moment
Empty Aircraft		111.7	
Oil		140.0	
Fuel		104.5	
Pilot		59.0	
Passenger		103.0	
Baggage		90	
Total			

YOUR AIRPLANE

Item	Weight	Station	Moment
Empty Aircraft		111.7	
Oil		140.0	
Fuel		104.5	
Pilot		59.0	

Passenger		103.0	
Baggage		90	
Total			

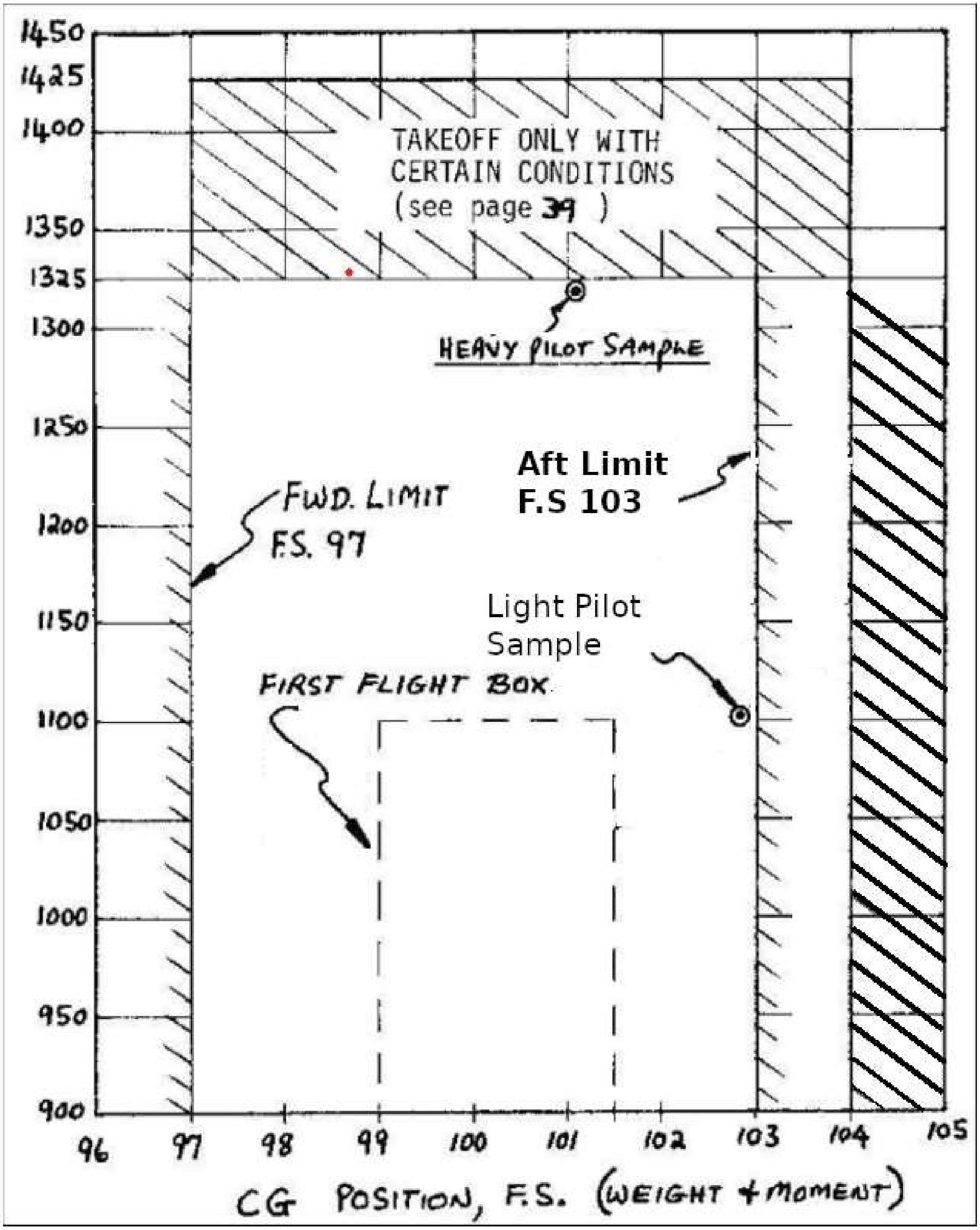
YOUR AIRPLANE

Item	Weight	Station	Moment
Empty Aircraft		111.7	
Oil		140.0	
Fuel		104.5	
Pilot		59.0	
Passenger		103.0	
Baggage		90	
Total			

YOUR AIRPLANE

Item	Weight	Station	Moment
Empty Aircraft		111.7	
Oil		140.0	
Fuel		104.5	
Pilot		59.0	
Passenger		103.0	
Baggage		90	
Total			

Weight and C G Limits



NOTE

Max gross weight limitation of 1425 lbs is allowable under certain conditions. See page 36 of this manual.

APPENDIX I

INITIAL SYSTEM CHECKOUT

Before initial taxi testing is started, each new aircraft should have a very complete inspection and functional test of it's flight systems. Factory built aircraft are given a similar series of tests before the pilot ever sees it. The Long-EZ owner (as manufacturer of the aircraft) must perform these production tests. The following procedure should be used for initial system checkout and for each annual inspection.

GENERAL

1. Check all fasteners for proper security and safety tying.
2. Check canard attachment bolts for security and proper installation.
3. Check wing attachment taper pins, through bolts and jamb nuts for installation and security.
4. Check wing incidence, rudder, aileron 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"	= Measure at the top of the rudder at the trailing edge. Measure this with the pilot holding full rudder pedal while someone applies a 5 lb force inboard the rudder trailing edge to remove any slack in the system.
Elevator Travel	= 22° ± 2° trailing edge down. 22° ± 2° trailing edge up.

Ailerons must both fair into the wing at the trailing edge when neutral. At full deflection aileron trailing edge must travel 2.1" ± 0.3" at inboard end (measured relative to the wing Trailing Edge.)

Control System

- Check that the canopy seals are in place and that the canopy locking handle is adjusted so that it must be forced hard forward to lock. This is extremely important to eliminate any possibility of it being bumped open in flight.
- Check elevator and aileron push-rods for proper installation (spacers, washers, bolts, lock-nuts, clevis pins and safety clips for proper installation.

- Check elevator and aileron push-rods for freedom of movement throughout control travel.
- Check pitch, roll and yaw trim mechanisms for proper function and freedom of movement.
- Check Elevator and aileron hinge attachment screws for security and jam nut installation.
- Check elevator and aileron for freedom of movement throughout full range of travel without any binding or chafing.
- Check rudder pedals for freedom of movement, cable attachments and positive return to neutral position.
- Check rudder pedals for free rotation and cable guard installation (the four cotter pins on the pulley brackets.)
- Check cable clearance throughout the full range of travel.
- Check brake actuation for freedom of movement and positive return to neutral position.
- Check all rod ends for any evidence of bent tangs.
- Check elevators for proper mass balance – 12° to 25° nose down. Weight evenly distributed between inboard and outboard locations. Max elevator weight with mass balance installed are 3.9 lbs left and 3.6 lbs right. **THIS MUST BE CHECKED AND VERIFIED.**
- Ailerons for proper mass balance – "The aileron must hang between the angle that makes the bottom surface level and the angle that makes the top surface level after painting"..
- Check for 1/16" inch minimum clearance around all mass balance. **BINDING CAN OCCUR AT ELEVATED LOAD FACTORS IF THIS MINIMUM IS NOT MET.**

Landing Gear

Main Gear

- Double check that all attach bolts and axle bolts are installed and secured.
- Check tires for proper inflation pressure. Inflate the mains to 70-80 psi (75 to 85 psi for 6 ply tires) and wait 24 hours to determine if any leaks exist. Use 40 psi if 500 x 5 tires are used.
- Adjust brakes and test for proper function. Service with fluid ad required. Bleed by flowing from drain up to the master cylinder. Recheck rudder pedal travel for 6-6.5 inches.
- Double check for proper main tire toe-in (.25 to .50 degrees per side.)
- Check that wheel bearings are packed with grease and safety wired.
- Check brake mechanisms for safety tying.

Nose Gear

- Nose gear tire inflation - 40 psi.
- Check that wheel bearings are packed with grease and safety wired.
- Check axle nut for security and proper installation.
- Check shimmy damper for friction adjustment (2-4 lbs of side force at axle is required to rotate pivot.)
- Check safety tying and security on all actuating mechanism hardware.
- Light grease on retraction mechanism.
- While supporting the nose, cycle the gear to verify function and check that the gear locks in the down position. Cycle gear with a 10 lb load to simulate air drage load.
- Verify that the ose gear micro switch is activated in the last .1 inch of travel.

INSTRUMENTATION

- **Cylinder Head Temperature –** It is important that these two gauges be accurately calibrated prior to use. This can be accomplished using hot oil and a high temperature candy thermometer.
- **Exhaust Gas Temperature**
- **Pitot Static System –** Check for leaks
- **Oil Pressure –** Function check on initial engine run.
- **Tachometer –** Function check on initial engine run.
- **Fuel pressure –** Function check on initial engine run.

POWER PLANT

Check -

- Clock the prop for compression at the 10 O'clock position. For proper hand propping.
- Propeller bolts for proper torque (180 inch lg) and safe tying.
- Propeller track and cracks.
- Spinner track and cracks
- Engine mount bolts for security and safe tying.
- Oil level
- Mixture, throttle and carb heat controls for security and proper function.
- Magneto wiring. Be sure the mags are cold when the switches are off.
- Check that the magnetic impulse coupling clicks at or after top dead center.
- Cowling baffles must fit tight all around the engine and cowl to prevent overheating.

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 (located at the carburetor 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 grit sandpaper and paint on a coat of clear epoxy.
- Check freedom of the fuel valve. If it requires more than 10 lb force at the handle then the valve MUST be overhauled or lubricated with an approved fuel valve lube.
- Verify Facet fuel pump part number are #40108 (12v system) or #40154 or #480610 (24v system). If any other facet part number: remove the pump and verify that the inlet and outlet interior is white (nylon) not gray or black (not nylon). Pumps that do not have nylon inlet or outlet valves need to be immediately replaced as those valves fail in Avgas.

Caution

Under no circumstances should fuel of a lower octane rating than that specified by the engine manufacturer be used.

Be sure that the minimum octane is clearly labeled by each fuel cap. Color coding is: Red for 80/87; Blue for 100LL; and Green for 100/130.

Auto gas (especially the high aeromatic content no-lead) should never be used.

Weight and Balance

Your final weighing before initial flight testing is very important and should be done carefully. The measurements taken should be recorded in the air-frame log book and used in weight and balance data kept aboard the airplane (table on page 36.)

Equipment required:

Three scales – the platform type are nice. Align the scales or use grease plates to avoid side loading scales. Bathroom scales cannot provide accurate readings and should not be used. You need a level, a 12 ft decimal measuring tape, a plumb bob, chalk (for marking hangar floor) and some ballast weight (to keep the nose gear down on the scales with the gear extended.) Check the accuracy of your scales by weighing an item you already know the weight of.

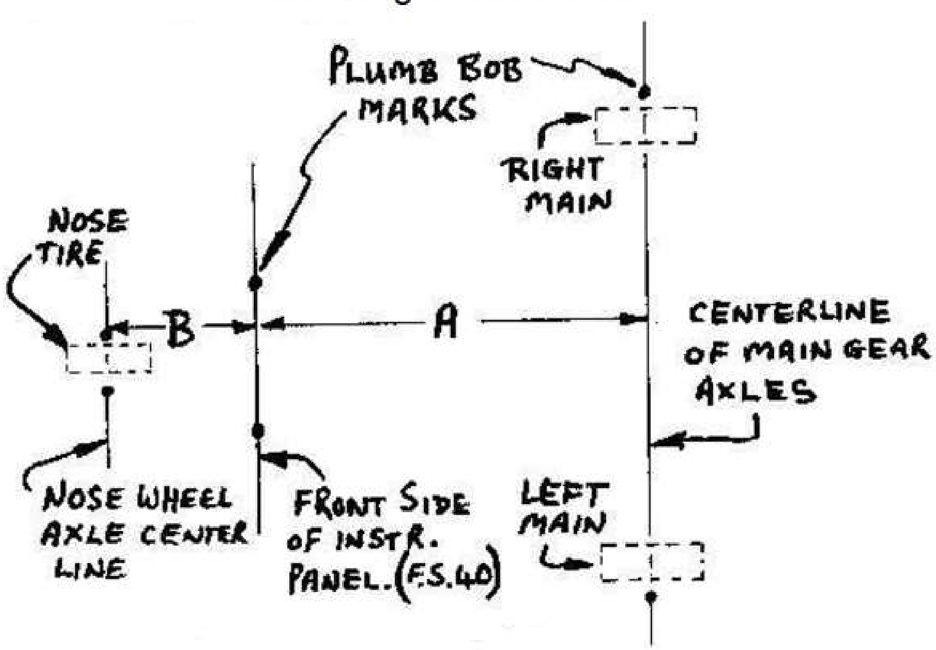
Position the airplane on the scales with the W.L. reference (top longeron) level. Put the ballast in the front cockpit along the instrument panel (F.S. 40) where your legs go through. Record the scales readings with the airplane alone (no fuel, no pilot, no baggage) Next, with the aircraft off of the scales (still level) use your plumb bob to mark the positions of the main and nose gear axle center lines on the floor with chalk. Also drop a line from the front edge of the instrument panel. And mark it's 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 extended to the floor.

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

When loading the aircraft for the initial flight testing and for initial pilot checkouts, it is important that the weight and CG fall within the first flight box (see page 28) however if a choice of one must be exceeded, an overweight condition (aircraft weight > 1100 lbs) is preferable to an aft CG condition.

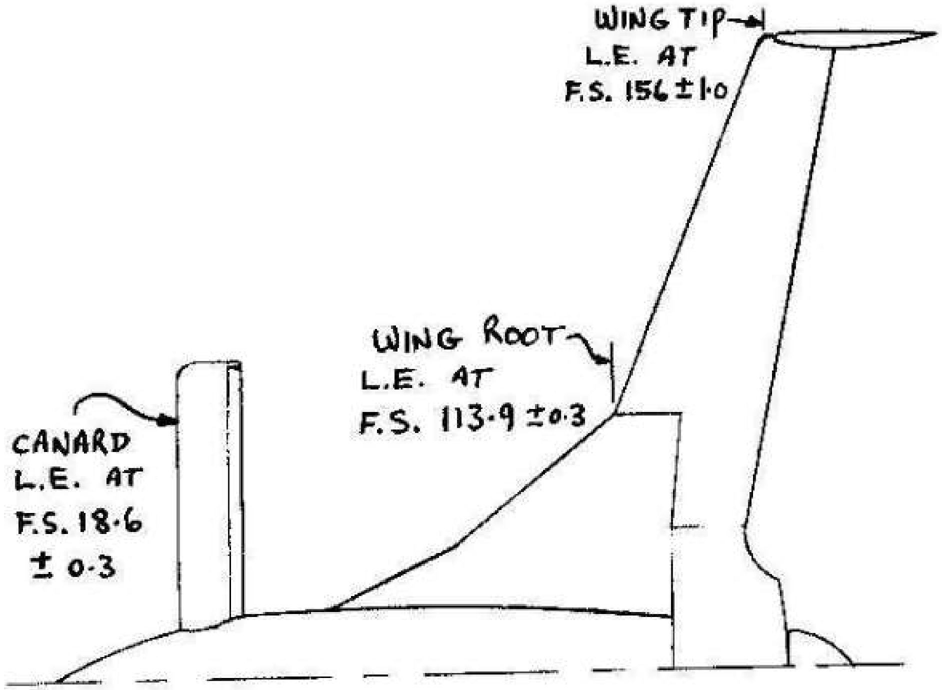
Measuring Reactions
for Weight and Balance



Mark these locations with leveled longeron.

Mark these locations with leveled longeron.

To get the



moment arm (fuselage station) of your main gear, add dimension A (in inches) to 40.0 (front side of instrument panel). To get the nose gear arm, subtract dimension B (in inches) from 40 (it should be about F.S. 20.0.) Be sure to weigh and record the ballast weight and then 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	372.0	110.5	4110
Scale Nose	9	-1.8	7.2	19.6	141
Ballast	-25	0	-25	40.0	-1000
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					

*Tare represents known weight that is present only to complete the measurement.

Divide total moment by total weight (81541/730) to get empty CG (111.7.) Remember that you have to subtract the weight and moment of the ballast for your official record. Record the empty weight and moment (730 and 81541 in the sample above) for your airplane on the table on page 26. Determine the maximum pilot weight with zero fuel and no passenger that remains inside the forward CG limits on page 27. Do the same for the lightest using your empty weight and moment, full fuel and no passenger to determine the lightest pilot for the 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 lbs
Minimum 135 lbs

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 27 and try several sample problems with different 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 may be 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 inflated to 80 psi.
2. Maximum landing weight limited to 1325 lb.
3. Maneuvers limited to normal category (+3.8 g. -1 g. no abrupt maneuvers.)
4. Refer to gross weight takeoff distance chart on page 55. Lift off at 70 knots (80 mph) and climb at 95 knots (110 mph). See chart on page 55.
5. Before conduction over-gross operations, 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 cross-wind conditions. Max crosswind component is 8 knots.
6. High gross weight operations should not be considered a routine operation. The chance of surviving an off-airport forced landing diminishes 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 of 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 home builder 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 “fly” or “don’t fly” to your initial flight tests. With all the other things you are thinking about, it is best to give the decision (of whether the airplane is ready) to someone else. If you really get a bad case of “Home builder’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 “home builder’s syndrome” has been a major factor in many first flight accidents. Typical of this problem is where an individual spends all of his time and money building his airplane and for several years, lets his flying proficiency lapse. Very typically we find a finished home-built with the owner / pilot seriously lacking in pilot proficiency. In one case, the pilot who tried to fly the first flight on his home-built, had only one flight in the past 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 the aircraft than me?” The home-builder is understandably proud of his creation and becomes very possessive. So we fine the proud builder / pilot at the end of the runway “ready” for takeoff with possibly a bad case of “home-builder syndrome.” But he won’t know it until just after lift-off when he finds himself suddenly thrust into an environment he is ill prepared to handle.

The best remedy for “home builder syndrome” is to accept help on your flight testing from an experienced Long-EZ or VariEze pilot. Then get a good checkout from them after you meet the currency requirements on page 24.

GROUND TESTING

Don’t just race out and fly your airplane, first thing. You will spend a while checking out all of the systems on the ground before you leap off on the first flight. The first order of business is to check out your engine system thoroughly. Ground run it for an hour or so at low to medium power. Run it with the top cowling off and look for excessive vibration, safely wired hardware, leaky fuel lines or anything else unpleasant. After this initial run-in (or the manufacturer's recommended run-in for a new or overhauled engines), check everything out carefully. Recheck the exhaust nuts for torque, look for leaks around gaskets, loose clamps, 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 through the prop.

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

LOW SPEED TAXI

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

Refer to "Pilot Position" on page 11, to setup 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 familiarize yourself with the cockpit environment 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 taxing can overheat the brakes. At 35 knots you will note that the floppy feel of the control stick is gone and air-loads now provide a comfortable centering feel.

Recheck that your weight and balance is within the "first flight" box on the diagram on page 28. 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 air worthiness certificate.

HIGH SPEED TAXI & NOSE WHEEL LIFTOFFS

Before conducting the following tests with your new Long-EZ, do all of them first with two different airplanes in which you are proficient. These maneuvers (nose wheel lift-offs 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 home-built during their initial testing. The safety record of home-built aircraft during their first flights is not as good as it could be if the owners and pilots would follow cautious procedures during initial testing.

- Weather – Calm wind or smooth wind straight down the runway.
- Smooth air – check turbulence in another airplane.
- Runway – at least 3500 ft, preferable 4000 ft.
- Fuels – 10 gallons each tank.
- Pilot – see pilot experience requirements (page 24) for absolute minimum criteria. Do not fly a new airplane when fatigued. Go home, get some dinner and sleep. You will be more alert in the morning.

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

The purpose of this phase of testing is to evaluate the aircraft's performance and trim during high speed taxi / nose wheel lift-offs, to acquaint the pilot with the pitch and yaw characteristics of the Long-EZ and most importantly, to give them the correct visual cue of zero height to allow them to judge flare height on their 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 except during braking.

Next step is to practice speed control before attempting nose wheel lift-offs. It is 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 witht 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 to 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 careful not to over-rotate. Always keep the canard well below the horizon. The pilot should not allow the aircraft to exceed 60 knots during this exercise.
When you've done enough runs down the 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 positive 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 always keep his forearm on the arm rest and use his wrist to control pitch. The rudders can both be deployed 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 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. Over-controlling pitch. The novice pilot will expect the Long-EZ to handle like the Cessna 150 or whatever he last flew. The experienced pilot knows that the 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 armrest and control pitch with the wrist only. Do not over-rotate! The highest rotation you should see during this or the later flights is the canard up to but never above the horizon. Better yet, keep it always at least 2 degrees below the horizon.

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 28 for initial flight tests. First flight is not intended to demonstrate the capability of your aircraft or the pilot and should be flown 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 the first flights are best done by fools, never by professional test pilots. During your climb out, set your pitch and roll trim to trim your airplane for hands off flight. This will be a handy reminder of the trim direction, if the airplane needs adjustment. You will notice a small roll trim change when you reduce 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 touchdown (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 gas-collator, electric fuel pump screen and the carb screen. Also remove and clean out carb float bowel. 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 28. 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 the initial testing, spend a few hours becoming thoroughly comfortable in your pilot tasks. When you feel at home in the airplane, begin your expansion of the weight, CG position, load factor and airspeed ranges. Do not feel obliged to expand into full ranges shown in the plans and in this handbook. Expand your limitations slowly and if you reach a point where you feel uncomfortable, stop. The ranges shown are those demonstrated 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 home-builder construction tolerances can effect flying qualities and performance. For example, your airplane 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 on your aircraft, you may want to change the placard 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 the squawk unresolved. Find and fix problems as you encounter them. Airplanes usually give a hint of impending trouble. The problem is we pilots 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 a bunch of fun.

FLIGHT – FLUTTER ENVELOPE EXPANSION

The first time you exceed 130 knots (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. (4 different tests)
- 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 over-speed the engine RPM. If you have just increased speed and find lower damping (i.e. the structure of controls shake more after the jab than at the previous, five know lower speed), do not continue to higher speeds. Recheck balance weights of control surfaces. Solve any suspected cause of low damping before expanding airspeed. Expand airspeed to at least the red-line speed you desire to place on your aircraft, up to, but do not exceed 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 deterioration.

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 a glass structure damage, repair as shown in Section 1. Delaminations are rare, due to the proper design of joints (none have occurred on the prototype.) If a delamination occurs (skin trailing edge joints, etc.) spread the joint, sand the surfaces dull, trowel in flox, clamp back together and let cure, or use the method in the construction manual.

Inspect suspected de-bonded (areas where skin has separated from the foam) by tapping a Quarter coin across the surface. A de-bond will give a dull thud compared to the "sharp knock" of the adjacent good area. De-bonds must be repaired by injecting epoxy in one side of the area and venting the air out the opposite side.

Ground the aircraft if any core damage area is larger than the following:

Fuselage, Wing / canard – 3" diameters

Winglet, control surface or outboard wing – 2" diameters

Repair all suspect areas (even 1" diameter ones) by drilling #50 holes and injecting epoxy in one side of the void/bulge/dent area until the epoxy vents out the bulge (any divergence from the intended smooth contour) must also be repaired and reinforced per the standard repair methods in the plans.

PLEXIGLAS CANOPY

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

Scheduled Maintenance / Inspection

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

Every 25 hours

1. Inspect the prop and spinner for damage / cracks.
2. Prop bolts – Check torque (wood prop 180 lb) and re-safety. Check after initial run, at 10 hours and every 25 thereafter. If your aircraft has recently moved from a wet to a dry climate, check prop bolt torque before next flight.
3. Engine cowl – Remove and check baffling for cracks.
4. Engine Oil Change – (50 hours for spin-on paper element filter)
5. Engine Oil Screen – (back accessory section) Clean first oil change and every other thereafter.
6. Fuel filters – Remove and clean (gas-collator, electric fuel pump, carb finger strainer.)
7. Fuel pump – Check for leaks from connections or from the pump itself.
8. Fuel lines – verify they are intact, properly and snugly connected and not chafing.
9. Fuel vent lines – verify that they are not clogged, facing aft, and still connected to the fuel tank.
10. Carb float bowl – Disassemble and check for contamination. Inspect float needle valve and seat. Look for gummy substance, clean if necessary. Perform this inspection each 25 hours until 100 hours then each annual / 100 hours thereafter.
11. Throttle / mixture springs – verify they are in fact attached on both ends and not broken.

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 gas-collator drain valve causing a slight leak. If this happens remove the bowl and flush the valve.

12. Exhaust system – check for cracks, leaks, 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.

13. Air filter – check and replace (if necessary)

14. Brake fluid level – checking

15. Cables, push rods, fuel / oil lines and electrical wites – check for chaffing.

CAUTION

If you have not replaced the CS132L (aileron) belhorn with the CS132L-R belhorn use a bright light and a magnifying glass to examine the weld of the belhorn to the shaft. Any signs of cracking in this area requires the aircraft to be grounded until the belorn weldment is replaced with the new CS132L-R.

Note that one indication of possible aileron flutter is the condition of the rod end where it connects to the belhorn. If the rod end is not stiff, then you've caught the situation early. Replace both the CS132L weldment with CS132L-R and the rod end and re-balance the ailerons.

16. Fuel system – pressure check (electric pump on) for leaks and correct pressure – 2 to 8 psi.

17. Engine Run – Check for leaks, mag drop, mags grounded, idle speed / mixture and idle mixture cut off.

18. Landing gear attach fittings – Check for security or damage.

19. Canopy – Check hinges for damage, locking mechanism for rig / snub, safety catch operation.

20. Tires and Brakes – Remove wheel pants, check tire inflation (70-80 psi mains, 40-45 psi nose), cuts, wear. Check brake pucks for wear. Adjust nose wheel friction damper 2-4 lbs side force should be required to swivel the pivot.

21. Nose gear retraction – Grease worm gear. Check for damage, wear and gear-down warning micro switch adjustment.

22. Lights – Nav, landing, strobe, cockpit, Check operation.

23. Conduct a general inspection of all composite structure. Any visible crack must be investigated to determine if it is only paint and filler damage or it it extends into the fiberglass structure. All paint and filler cracks should be repaired or sealed to prevent water intrusion. All fiberglass damage must be re- painted before flight. Check skin surfaces for evidence of depressions or bulges that indicate a failure of the underlying foam core. Note the integrity of the underlying core by pushing on the skin and tapping with a 25-cent coin. Good core is indicated by a sharp “tap” or “knock” noise. Bad core is indicated by a “dull thud”. Listen carefully as you tap and mark with a grease pen directly on the skin the boundary of any suspected dis-bond area. Ground the aircraft if any core damage areas is larger than the following: Fuselage, wing / canard – 3” diameter. Wing-let, control surface outboard wing – 2” diameter. Repair per instructions on Composite Structure section on page 44.

ANNUAL / 100 HOURS

Accomplish all items listed in the 25 hour inspection guide, plus all the items in Appendix I (page 29) 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 re-weighted at the first annual. You may be surprised. Update the weight and balance form. Reweigh every 3 years or after any major modification.

1. Nose and Main wheel bearings – repack.
2. Air filter – replace.

3. Engine – Reference to manufactures inspection manual. Be sure to check mags grounding / timing, clean and gap spark plugs (0.18”). Reverse top and bottom. Check compression. If below 70, 80, investigate. Ops check engine controls, throttle, mixture, carb, lube and check for freedom of operation.
4. If you use a 6" long or longer prop extension, remove the cowling and spinner and carefully inspect the prop extension using a strong light. Look for machine tool marks (chatter marks) in the two radii or a radius smaller than 1/4" or hairline cracking in the anodized finish in the radii. This is particularly critical if you have a Lycoming 0-360 engine. Discovery of any of these flaws is a ground-the-airplane problem.
5. Control system – Inspect and lube all hinges, rod ends, jam nuts, bearings and check for binding.
6. Canard – Remove the canard (see page 50) and inspect rudder pedals, battery, nose gear retraction mechanism, canard lift tabs for damage / elongation, elevator torque tubes for damage or corrosion, elevator balance weights for security / binding.
7. Pitot static system – check for leaks.
8. 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 forwarded to engage the lock.
9. Wings – remove both wings (see page 51) 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.
10. Main gear attach. Inspect with a mirror and a flashlight to determine if the gear attach tabs have slid aft on the LMGA steel tube. This is not a structural problem, but may cause the nylon brake lines to be pinched between the trailing edge of the main gear strut and the fuselage side where the gear comes out of the fuselage. If you find any evidence of movement in this area pry the gear forward to its proper position on the LMGA tube then fill the gap between the aft attach tab and the aft aluminum extrusion on each side with flox. Allow to cure for 24 hours before flying.

11. Inspect the entire surface of the aircraft inside and out. Look for evidence of cracking / delamination or deformity of any kind. See composite structure on page 44.

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 structural 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 / INSTALLATION

You can remove the canard by yourself in about 5 minutes. Tools required: one 7/16" socket wrench and a 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 bulkhead so no back up wrench is required. Remove the bolts, label them (they may be different lengths) and record the number of washers used. There are no washers between the lift tabs and the bulk head. Carefully lift the canard up and forward. Set the canard upside down on foal block or soft material so as to not scratch the surface. Be especially careful of the elevator push-rod 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 may be 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 of 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 ¾" x 3/8" drive sockets, two 3" extensions, one 3/8" drive ratchet, one 3/8" drive breaker bar. (A knife to remove the wing bolt access cover plates.)

Procedure:

1. Remove the cowling, disconnect the aileron push-rod and the rudder cables using the quick disconnects.
2. Disconnect the Nav / Strobe light wires.
3. Remove the three wing access hole covers.
4. Support the wing tip and proceed to remove the three wing attach bolts. To remove the two outboard bolts use the ratchet on the wing side and the breaker bar on the lower spar hole. The single inboard bolt access is from the inside in the cowling area in the wing root. Access to the nut for this bolt is from inside the center section spar accessible 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 wind and slide it aft and off the aircraft. Note the number and position of each incidence shim washer on each bolt. These shims control the incidence of the wing and should be replaced exactly as they came off. Set the wing on foam block or other 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 the torque wrench in the access well, it is 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 lock-nut. 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 (FAR01.) 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. Air-frame and engine log books are required as in any other aircraft. One area that is different from production aircraft is the method for maintaining records of major repairs and alterations. A major repair or alteration of the LongEZ requires re-licensing and issuance of a new airworthiness certificate and new operating limitations instead of FAA form 337A / Radio equipped aircraft must also have a valid FCC 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 #

____

____

____

____

____

____

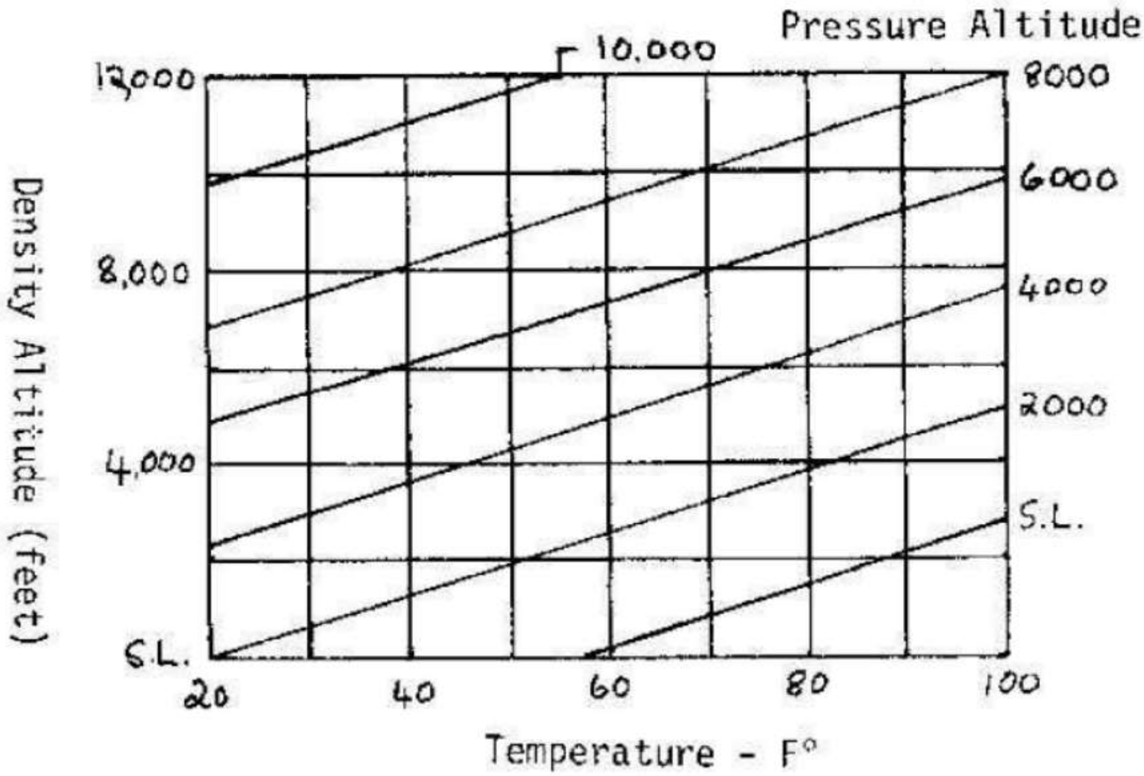
____

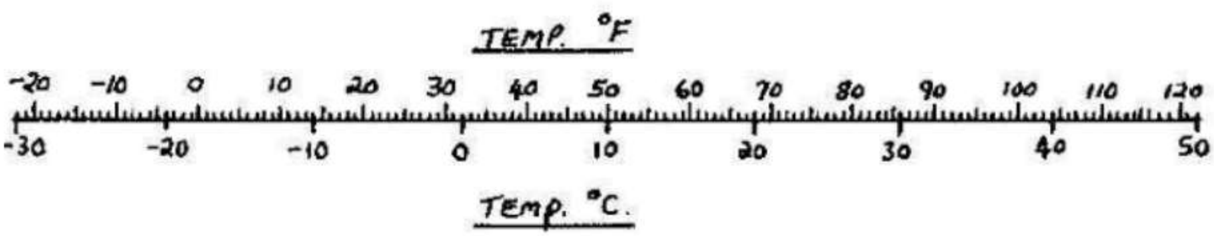
____

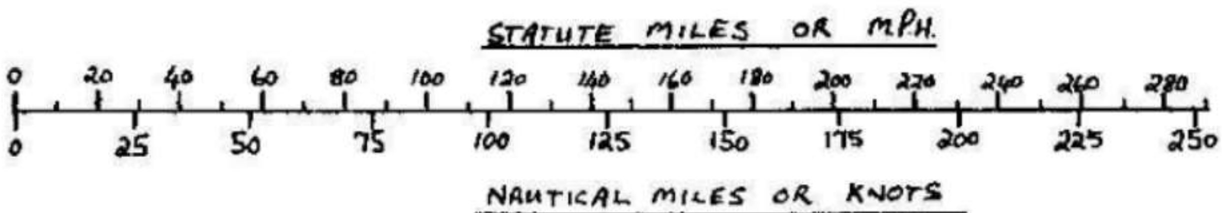
APPENDIX V

PERFORMANCE DATA

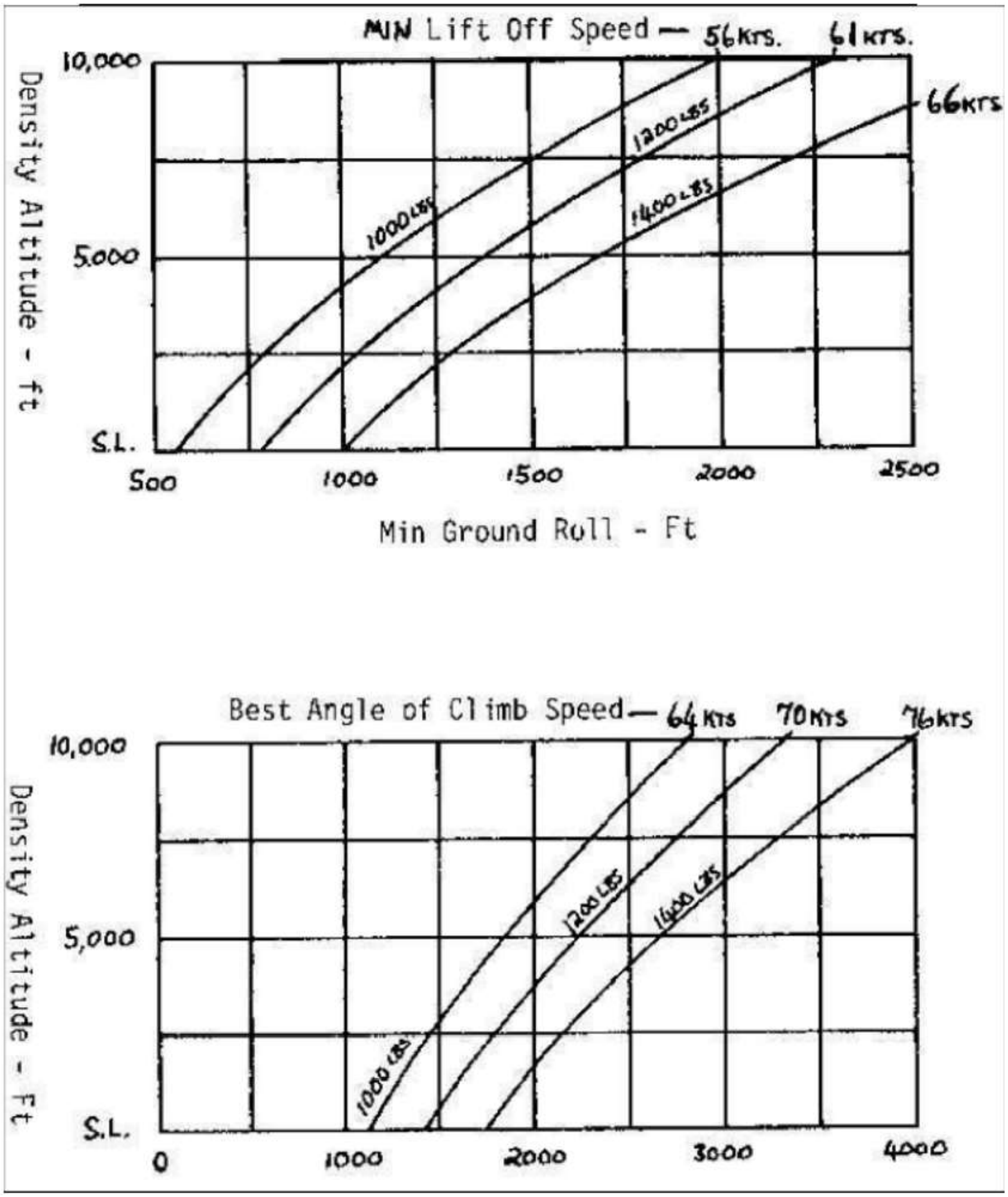
To determine density altitude







TAKEOFF DISTANCE

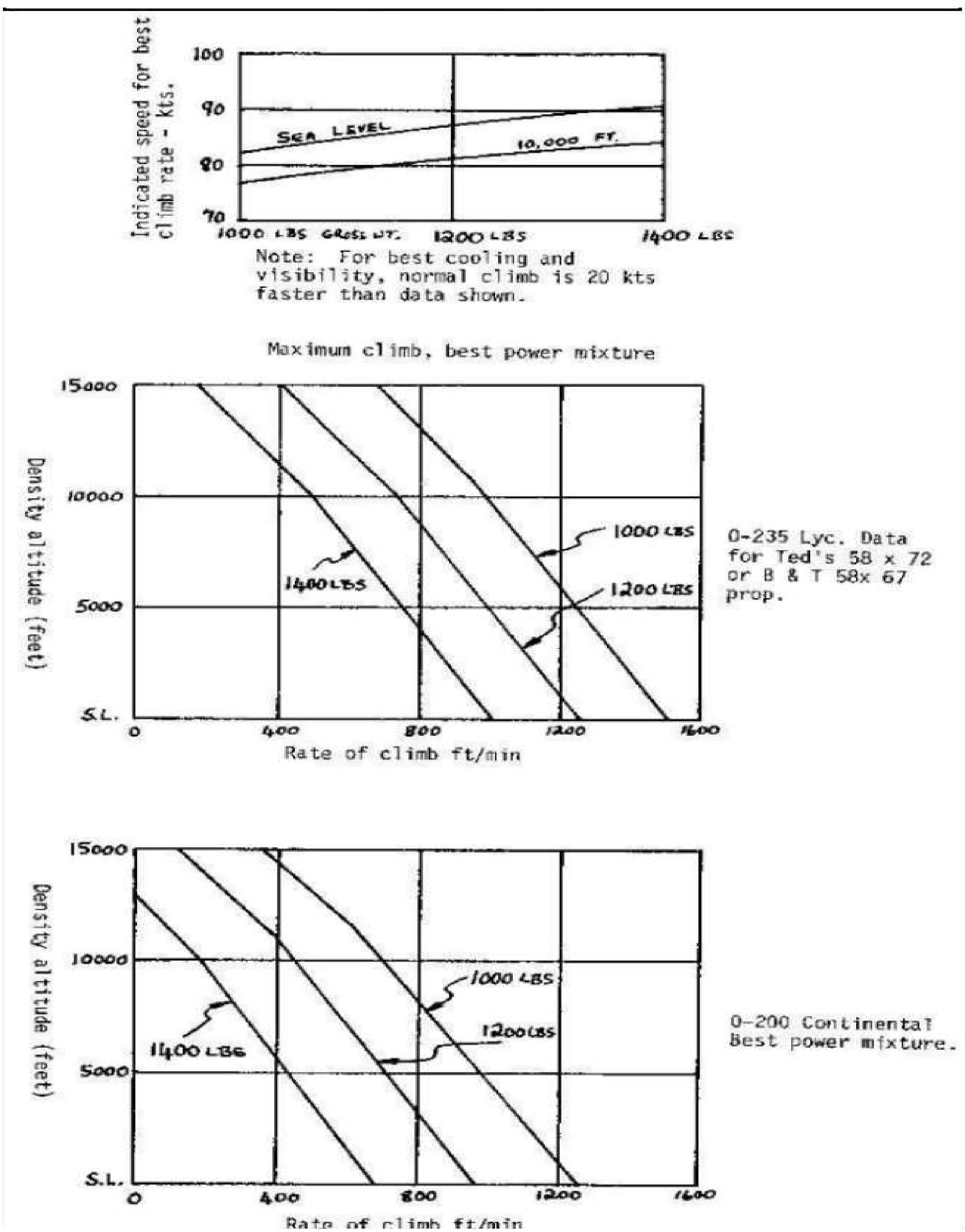


NOTE:

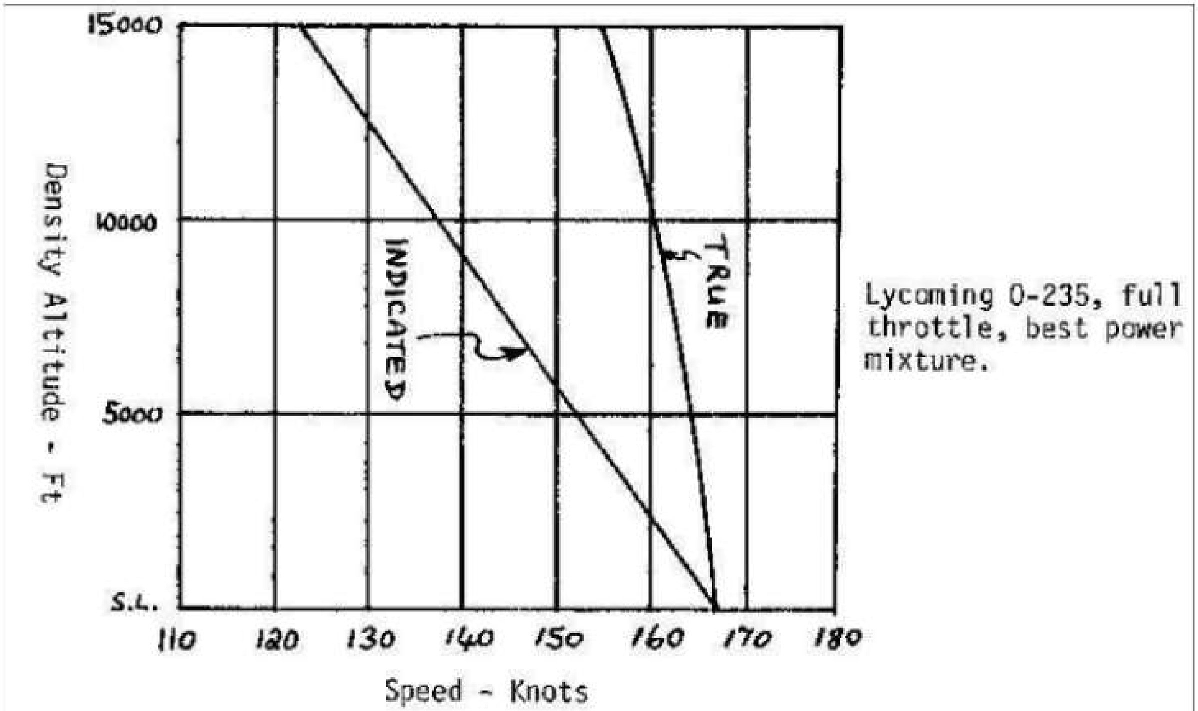
1. Data for Lycoming O-235 and Ted's 58 x 82 or B&T 58 x 67 props. Multiply data by 1.2 for O-200 Continental engine.
2. Due to brake steering requirements, crosswind can extend takeoff roll. For a 15 knot crosswind componenet, multiply takeoff roll data by 1.25.

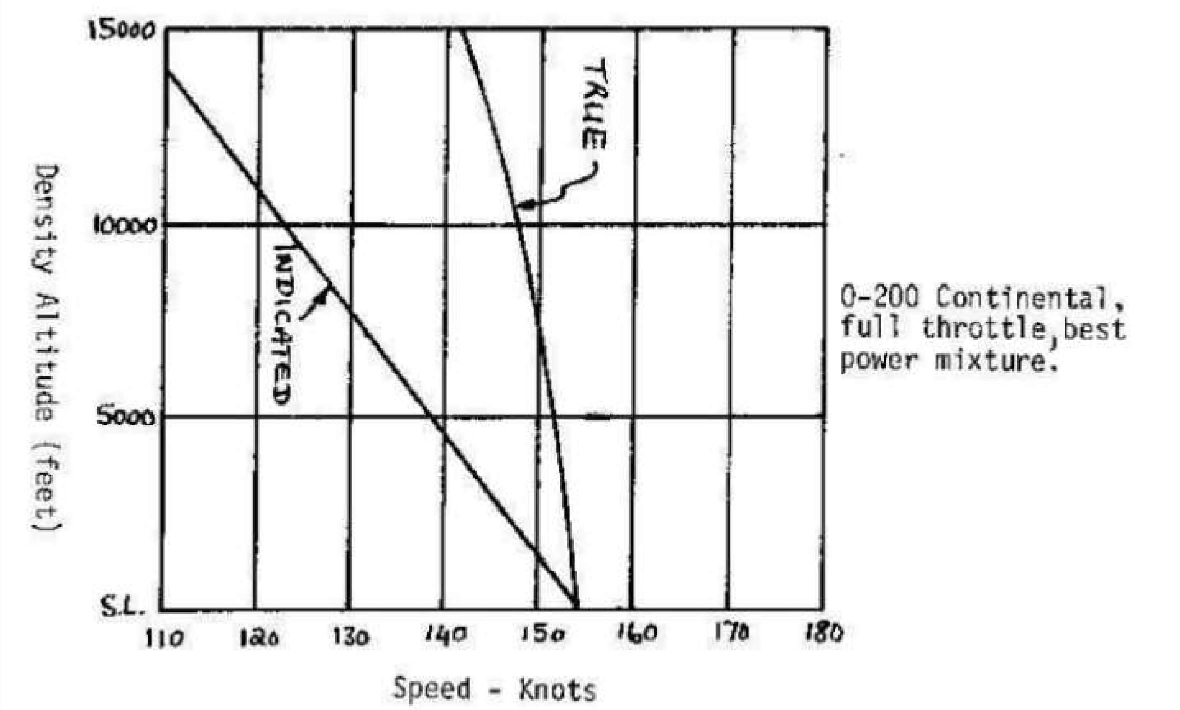
3. At forward CG the nose wheel lift off speed is higher than the “min ground roll lift off speed.” This can extend the takeoff distance as much as 20% at forward max CG.

CLIMB SPEEDS

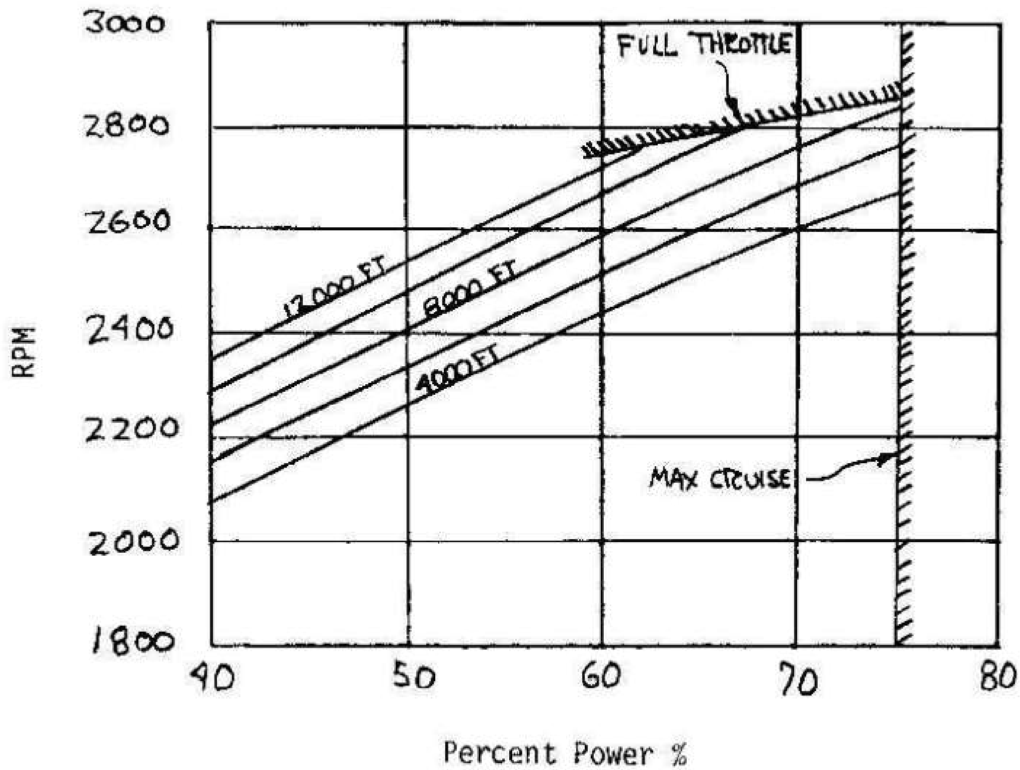


Maximum speed data for level flight (w/wheel pants): No wheel pants – subtract 5 knots





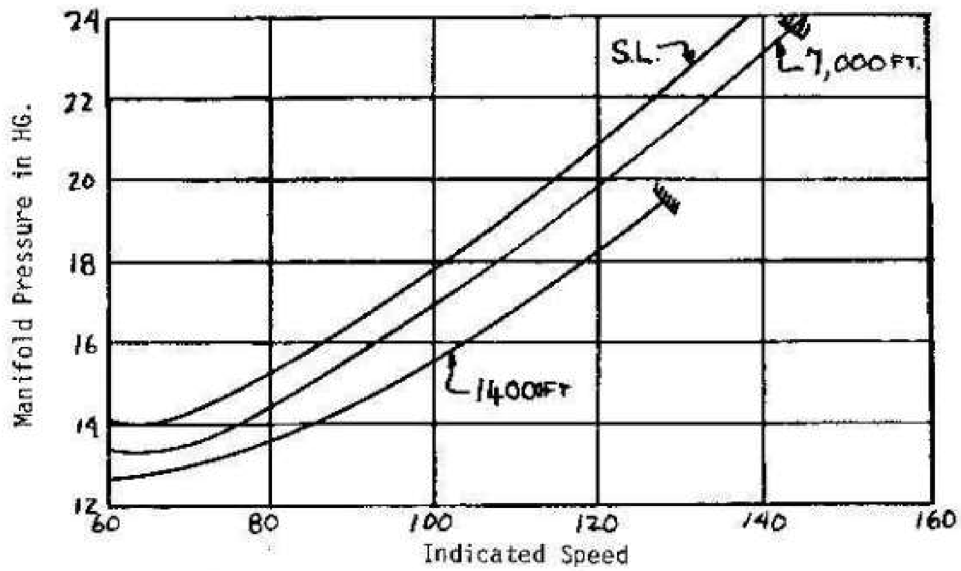
Approximate chart to set Cruise Power.
O-235 Lycoming
Ted's 58 x 72 or B & T 58 x 67 Prop

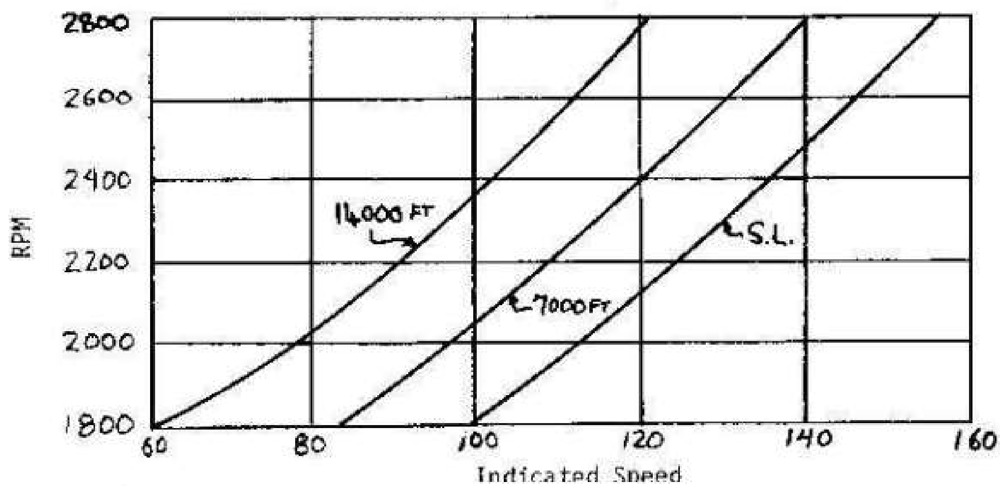


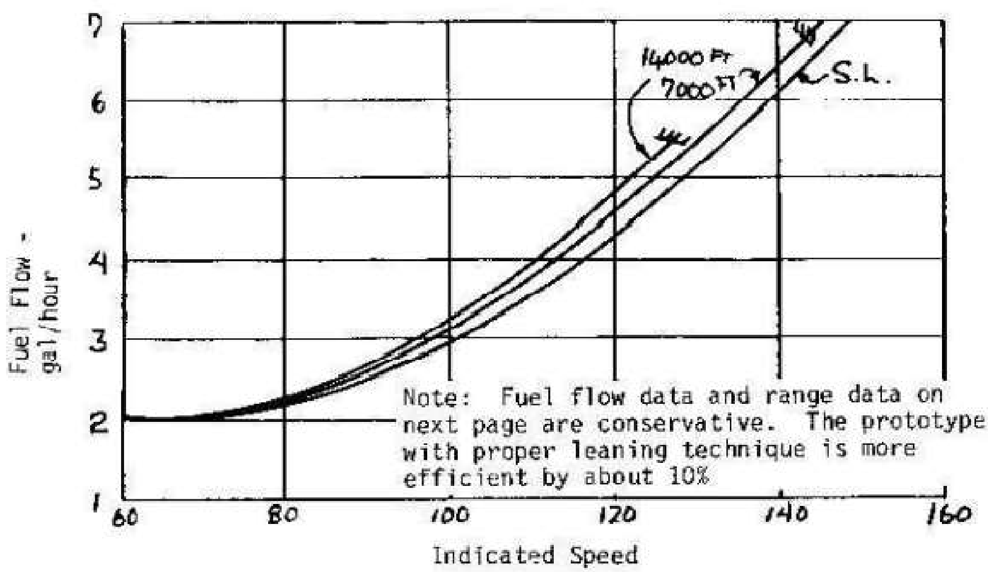
NOTE: Max continuous cruise speed (161 knots true) is obtained at 8000 feet altitude with full throttle (2840 rpm, 6.7 gsl/hr.) A good economy cruise condition is 2550 rpm at 12,000 feet altitude (50% power, 4 gal/hr) resulting in a true air speed of 137 knots.

Cruise Data

1100 lb weight	Ted's 58 x 72 or
O-235 Lycoming	B&T's 58 x 67 prop
Peak EGT mixture	


Manifold Pressure in HG.
24
22
20
18
16
14
12
60
80
100
120
140
160
Indicated Speed
S.L.
7,000 FT.
14000 FT


RPM
2800
2600
2400
2200
2000
1800
60
80
100
120
140
160
Indicated Speed
14,000 FT
7000 FT
S.L.


Fuel Flow - gal/hour
7
6
5
4
3
2
1
60
80
100
120
140
160
Indicated Speed
14000 FT
7000 FT
S.L.
Note: Fuel flow data and range data on next page are conservative. The prototype with proper leaning technique is more efficient by about 10%

RANGE

To Calculate Range

(1) Subtract 4 gal. From total fuel, for reserve.

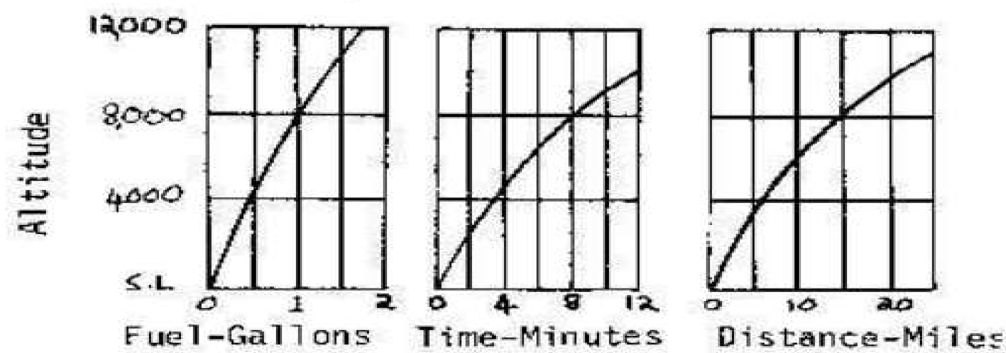
(2) Figure climb fuel and climb distance (top chart)

(3) Subtract climb fuel and look up cruise range from lower chart.

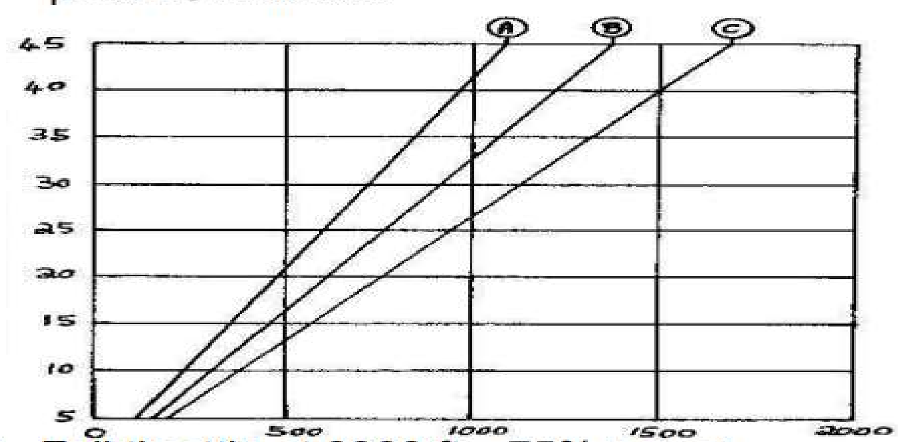
(4) Total range is climb distance plus cruise range.

Fuel, time and distance to climb.

Gross weight – 1325 lbs.



Cruise segment range-nautical miles
peak EGT mixture.

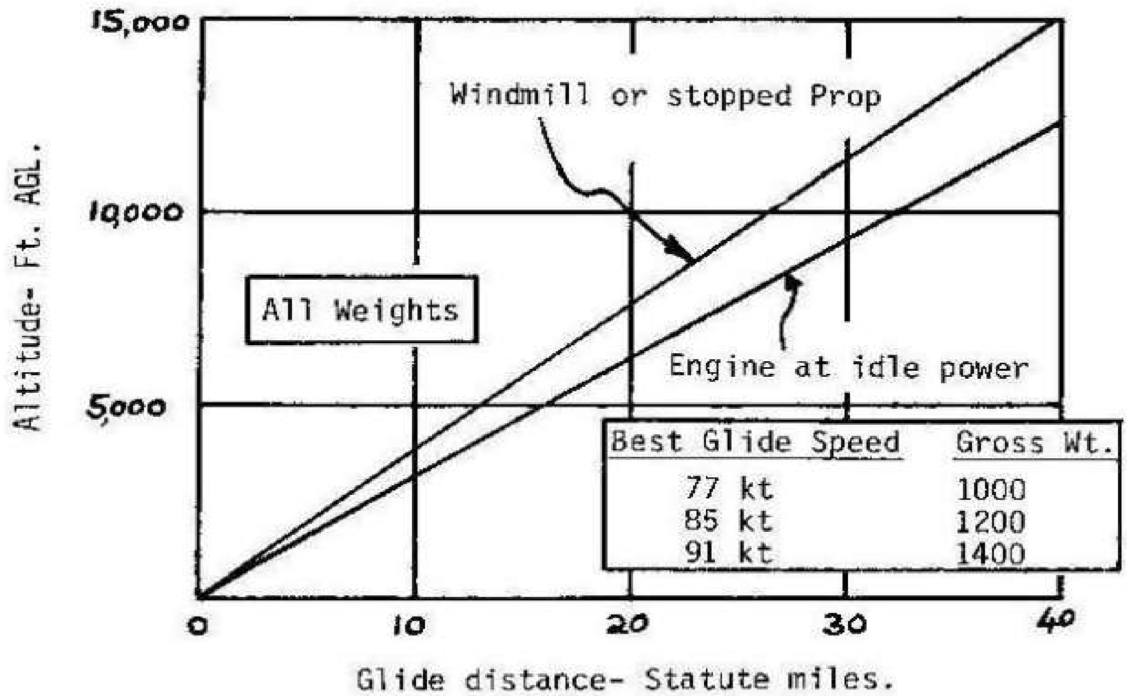


A Full throttle at 8000 ft—75% power max cruise 145 kt indicated, 161 kt true, and 6.7 gal/hr

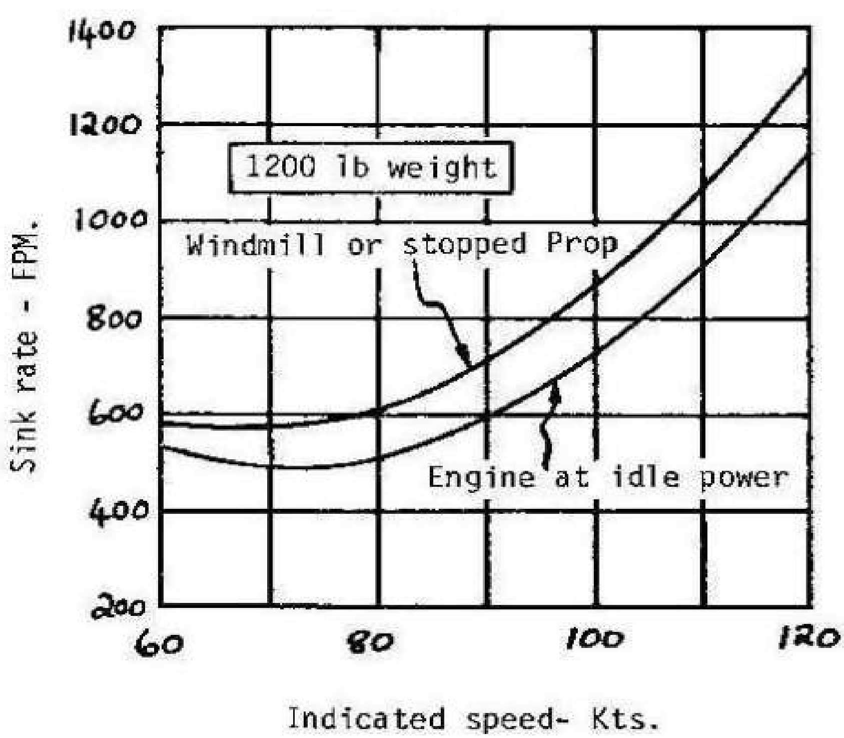
B Full throttle at 12,500 ft—60% power 122 kt indicated, 148 kt true, 4.9 gal/hr

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

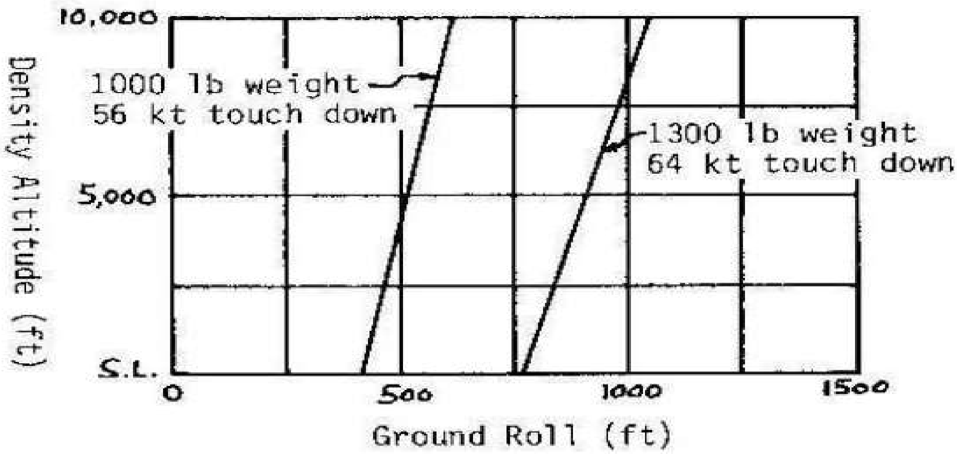
GEAR UP

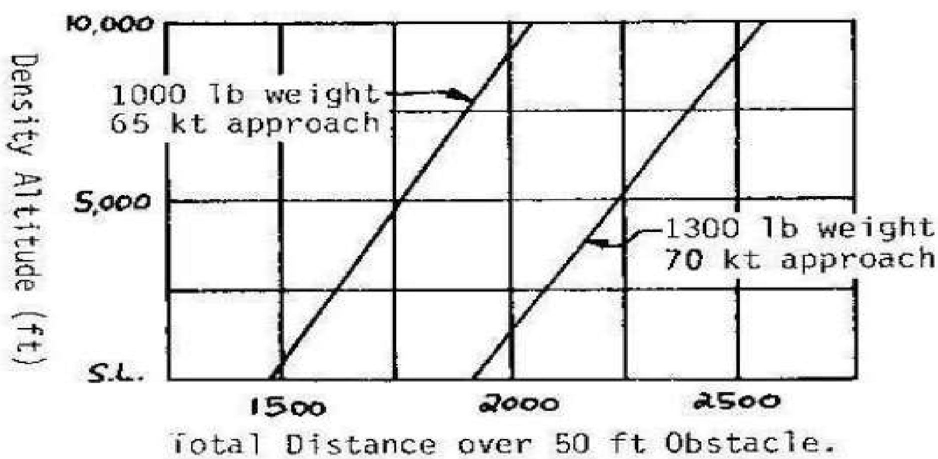


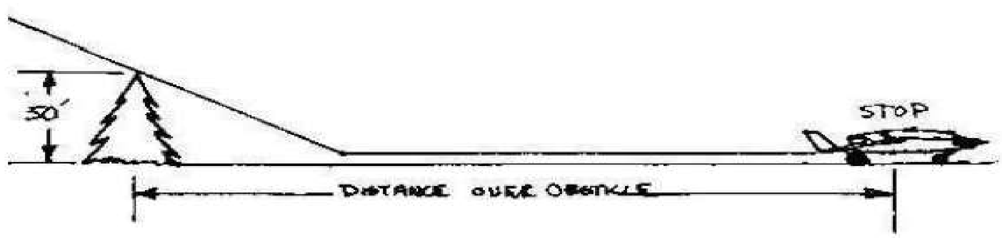
Sink rate- sea level- gear up.



Landing Distance – Landing Brake Extended

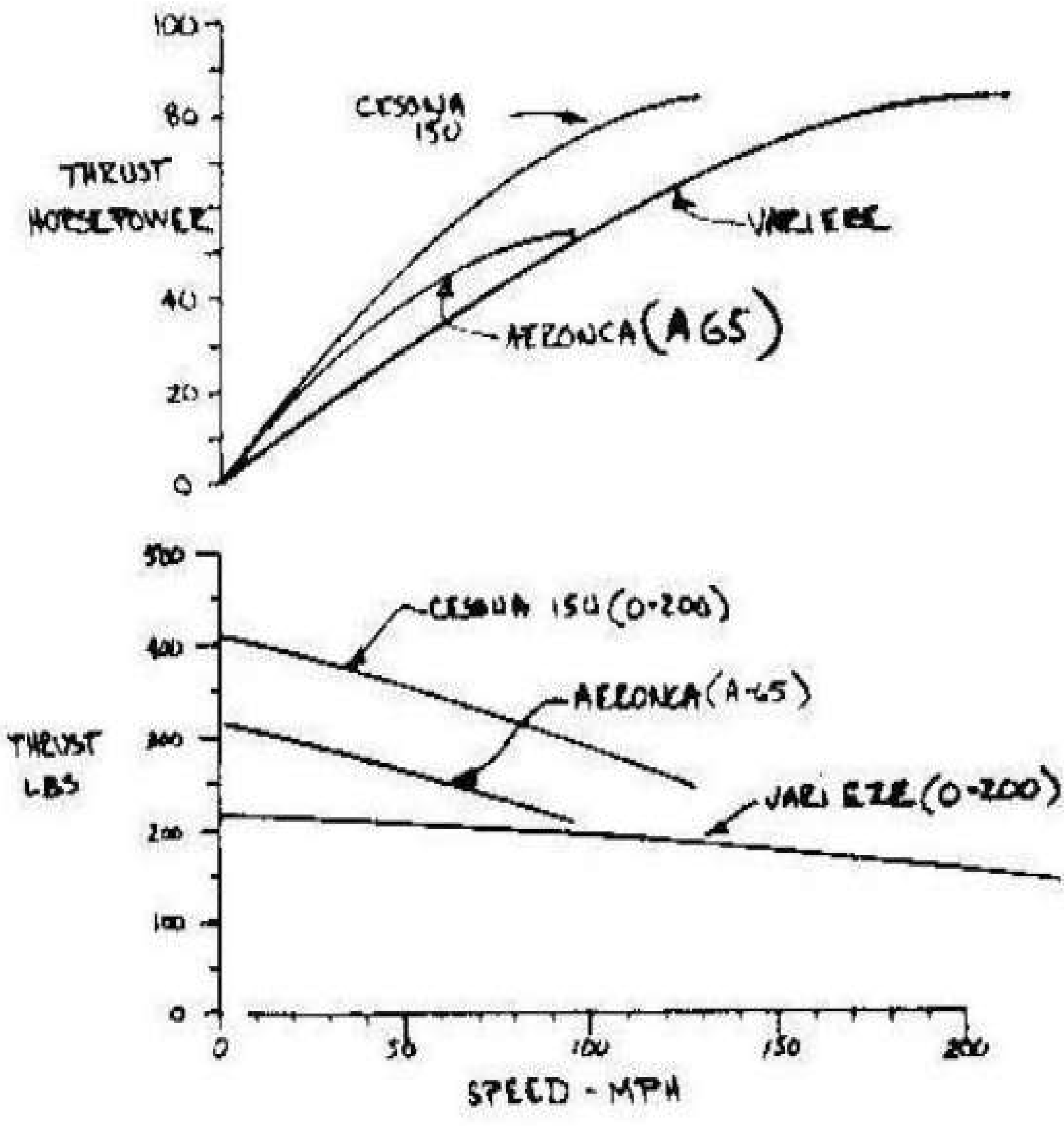






Pusher Engines: As you engine experts know, the Continental O-200 (100 hp) engines have a crankshaft for an FAA approved pusher installation. These special cranks are rare and expensive. We don't believe that these special parts are necessary for the LongEZ. The difference between the 'pusher' O-200B and the tractor O-200A is a reinforced

flange to take the high static thrust lads that you find in amphibian type or other slow aircraft.
The O-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 O-200A 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 hours of flying time with the O-200A Continental engine. No measurable end-play wear has occurred. Absolutely no problems have been encountered.

LongEZ Airworthiness Directives

Number	Description	Date Completed

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. Be very complete with this list and keep it updated. 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.

Serial#___________________ Registration# _______________ Date ___/____/____

Paint type ________________Color: ______________________ No. ______________

Trim Type ________________ Color: ______________________ No. ______________

Interior Type _______________ Color: ______________________ No. _____________

Status of Equipment: X installed

O installed

Status	Item	Weight	Arm	Moment
	Engine			
	Prop			

LONG-EZ CHECK LIST

EXTERIOR PREFILIGHT INSPECTION

COCKPIT

Mag Switches – Off
Master Switch - On, check battery condition and warning system
Master Switch – Off
Mixture – Idle Cutoff
Throttle – Idle
Cockpit Access Door – Closed, key removed
Flight Control Lock – Removed
Stick – Free and unobstructed both forward and rear cockpits
Rudder Pedal Area – Clear of loose items, Unneeded ballast removed.
Rudder Cable / Quick disconnect – Secure
Pitch Trim – Check operation and cable connected.
Fuel Selector – On (left and right)

CANARD NOSE SECTION

Elevator – condition, hinges, balance weights secure
Elevator – Free
Static Ports – Unobstructed
Pilot Tube – Clear and undamaged
Nose Parking Bumper – Check conditions

Right fuselage / Wing

Canopy Hinge – Undamaged
Fuel quantity – visual check
Fuel Cap O-Rings – check condition
Fuel Cap – Secure (check alignment marks)
Fuel tank vents – Clear
Fuel tank Drain – Check free of contaminants
Fuel – Proper color (Red 80, Blue 100LL, Green 100, 130)
Wing and Verticle fin – Condition
Tie Down – Removed
Rudder – Free, cable / hinges secure, drain hole open
Rudder return spring – Secure, returns to neutralized

Nav Light – secure
Ailerons – free hinges, secure.

<u>AFT FUSELAGE – Engine</u>
Main Gear Strut – Secure, check that it hasn't slid aft.
Brakes – Check for wear, break lines are not exposed nor overheated from brakes.
Tires – Check wear and inflation
Cooling / Carb Inlet – Clear
Drain Gas-collator – Check free of contaminants
Cowling – Check condition – All fasteners securely
Propeller – 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

<u>Left Wing Fuselage</u>
Same as right.

<u>Nose Gear / Landing Brake</u>
Perform fuel and gas-collator drains prior to lifting nose.
Lift nose. Extend nose gear and landing brake. (hold the nose down during this check to prevent the aircraft from tipping over backwards.)
Strut / Pivot – Secure and undamaged.
Wheel shimmy damper – Adjusted (2-4 lbs force to swivel.)
Wheel well / door secure.
Tire – Check wear and inflation pressure.
Landing Brake – check for damage.
Landing Brake – Retract.
Nose Gear – Retract for hand starting.

Engine Start – (with electric starter)
Lift nose, extend and lock the nose gear.
Board aircraft and hold brakes.
Mixture – Rich

Carb Heat – Off
Throttle – Prime and crack
Master switch – On
Auxiliary Fuel Pump – On to check pressure (4-8 psi)
Auxiliary 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
Throttle Idle
Mag Switches – Both on.
Oil Pressure – Check

Engine Start – (Hand Propping)
Park and Nose Bumper (Chock if necessary)
Mixture – Rich
Carb Heat – On
Throttle – Prime and crack
Master Switch – On
Auxiliary Fuel Pump – On to check pressure (4-8 psi)
Auxiliary Fuel Pump – Off
MAG-OFF
Pull prop through 8 blades
Area – Clear
Mag Switches – On (Lycoming left mag only for start)
Hand prop engine
Chock aircraft if necessary
Throttle – Idle
Mag Switches – Both on.
Oil Pressure
Lift nose and board aircraft

Before Taxi

Correct pilot position – Rudders adjusted, seat cushions to place head within 1 inch of canopy top.

Seat belts and shoulder harness – adjusted / locked.

Radio, Avionics, lights-- As required.

BEFORE TAKEOFF

Emergency Canopy Access Door – Closed and 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 Altimeter, DG, Attitude indicator, Clock)

Auxilary Fuel Pump – On

Engine Run UP – (List specific engine limitations)

- Mags
- Carb Heat
- Oil Pressure
- Fuel Pressure
- Gen / Alt output
- Mixture – Set as required
- Static RPM – 2450 minimum

Canopy – Locked, visually confirm proper canopy latch engagement and proper safety catch engagement.

CLIMB / CRUISE

Gear – Up

Fuel Pump – OFF above 1000 ft AGL

Mixture – Lean as required

Fuel Selector – Balance Management

DESCENTS / LANDING

Circuit Breakers – In
Fuel Selector – Fullest Tank
Mixture – Rich
Carb Heat – On as required
Fuel Pump – On below 1000 Ft AGL
Gear – Down below 110 kts
Landing brake – Deployed as required

AFTER LANDING / SHUT DOWN

Fuel 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 cutoff
Mags – Off
Master Switch – Off
Deplane, hold nose, retract gear, lower nose-down
Secure Aircraft – Canopy, controls, tie downs.