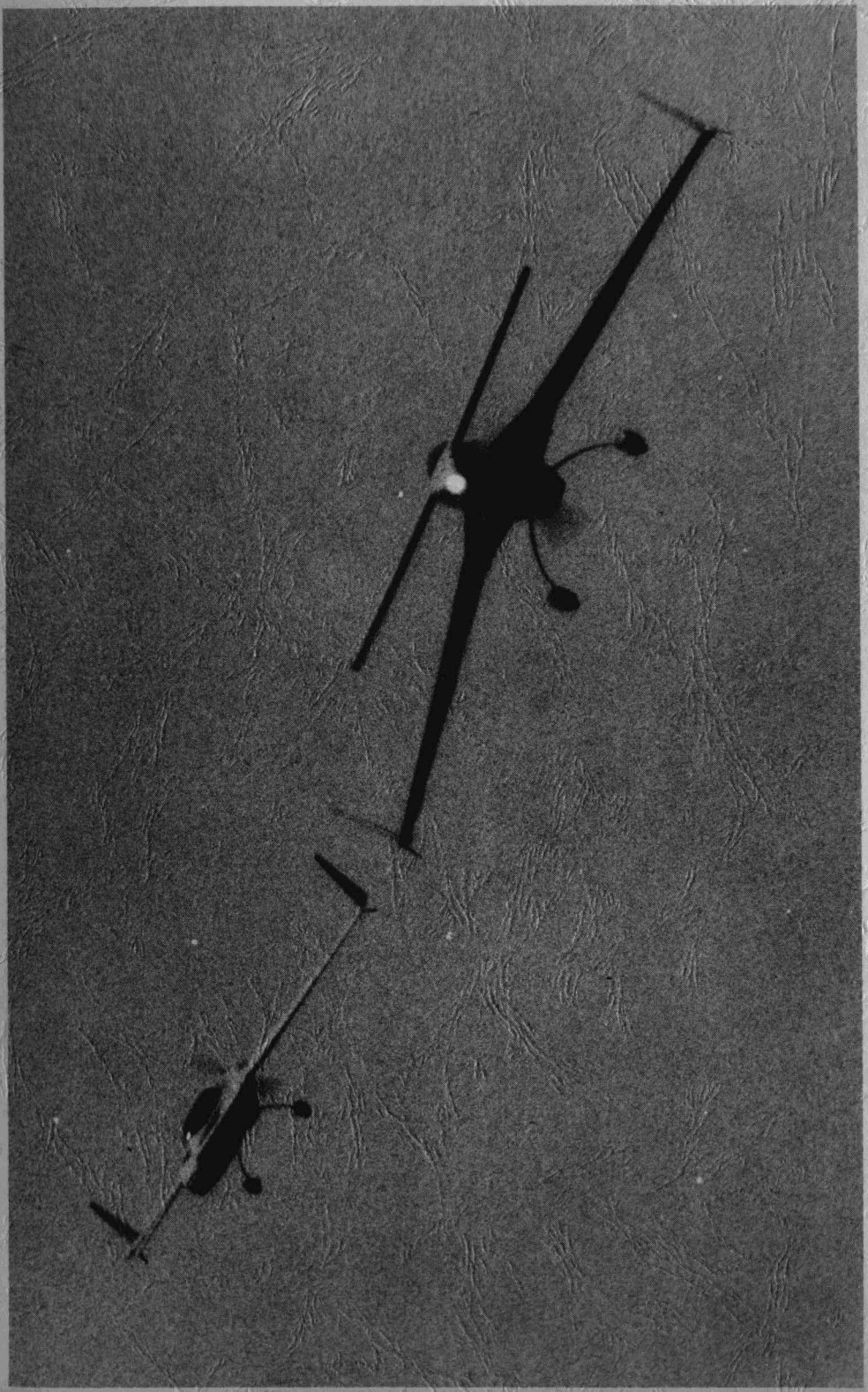
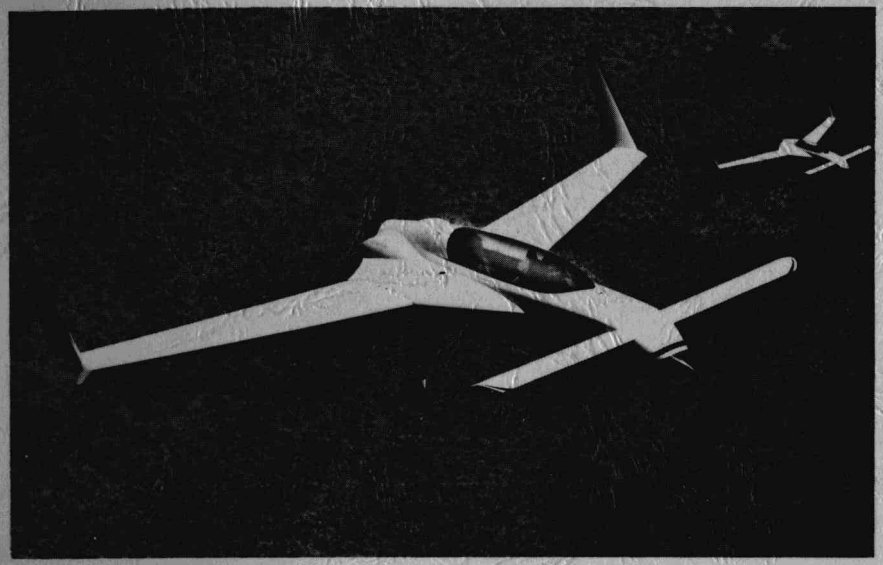


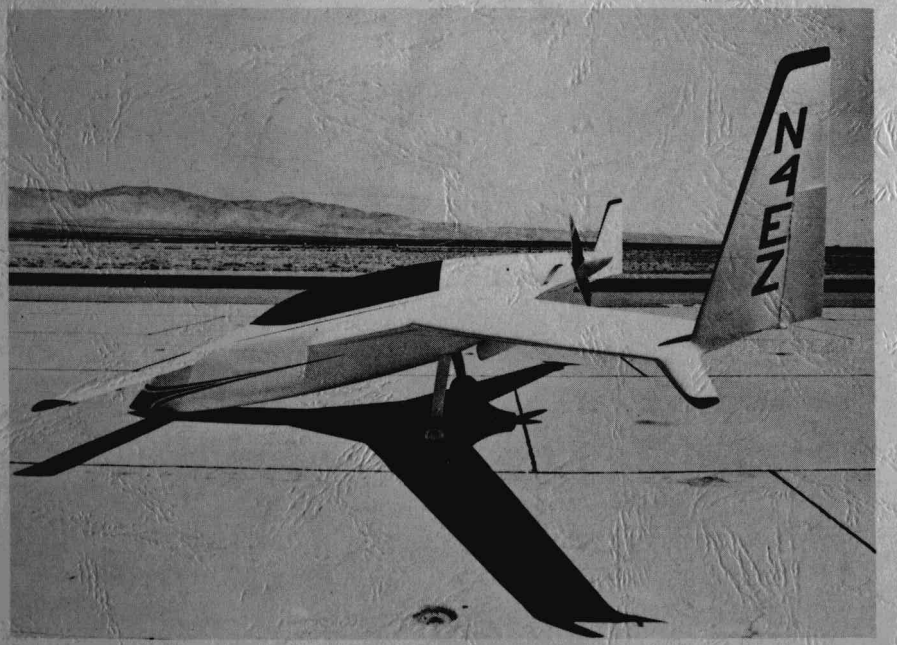
VariEze

OWNER'S MANUAL

SECTION IV OF THE VARIEZE MANUFACTURING MANUAL

Third Edition — December 1979





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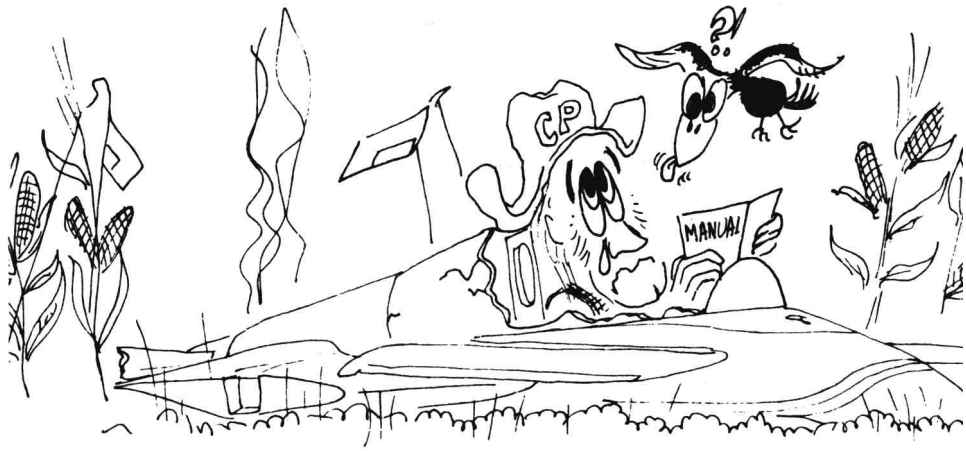


CONTENTS

NOTE

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

WARNING

THIS MANUAL IS OBSOLETE UNLESS UPDATED BY NEWSLETTER #23 AND ON.

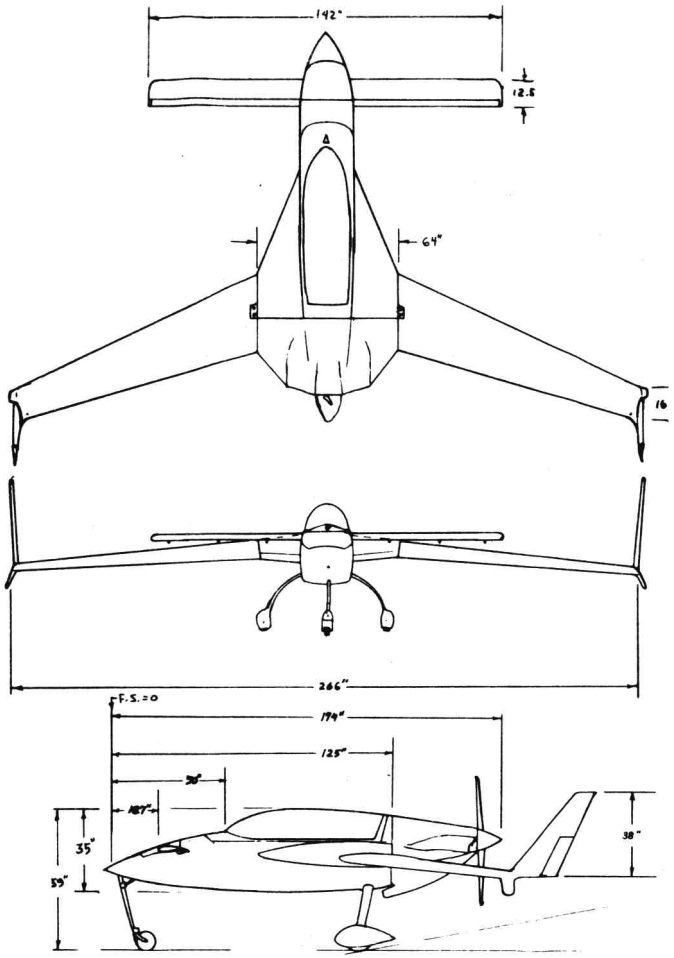
GENERAL DESCRIPTION

The VariEze is a modern, high performance, custom-built aircraft featuring the latest advances in utility, ecomony, comfort, simplicity and flight safety. Equipped with proven aircraft powerplants, ranging from 75 to 115 horsepower, the VariEze provides outstanding performance while maintaining simplicity and economical service. While limited to day VFR only, the VariEze offers exceptional utility: seating two large adults in comfort with two custom-fit suitcases and fuel for up to 800-mile range. Employing advanced aerodynamics and composite sandwich structure, the compact VariEze outperforms other aircraft with twice the horsepower and fuel flow. A radical break-away from traditional aerodynamic configurations and structures has enabled the VariEze to surpass its predecessors in performance, utility, and economy while maintaining comfort and flight safety.

The VariEze 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 VariEze's use of one-way rudders in each winglet makes use of the winglet camber to tailor the rudder forces. This results in low forces at low speeds where rudders are used, and higher forces at higher speeds where rudders are not needed.

DIMENSIONS

Wing span/Area	22.3 ft (6.8m)	53.6ft^2 (4.98m^2)
Canard Span/Area	11.8 ft (3.6m)	12.3ft^2 (1.14m^2)
Total Wing Area	66 ft^2 (6.12m)	
Length	202 in (5.13m)	
Height	59 in (1.5m)	
Cockpit Width		
Front	23 in (0.58m)	
Rear	21 in (0.53m)	
Cockpit Height		
Front	35 in (0.89m)	
Rear	34 in (0.86m)	
Cockpit Length		
Front	70 in (1.78m)	
Rear	54 in (1.37m)	



WEIGHTS

Normal empty weights are 560 lbs for a basic day-VFR VariEze with the lightweight, 75 hp engine, and 580 lbs when equipt with the Continental 100 hp O-200A engines. These empty weights are obtained only with the lightest electrical system, no extra avionics, equipment or modifications, good structural workmanship and minimum-weight finish. Any compromise of the above items will raise empty weight and limit useful load.

Allowable gross weight varies with the installed horsepower as follows:

Horsepower	Gross Weight
75	950
85	1000
90 to 115	1050

NOTE

A gross weight of up to 1110 lbs can be allowed for take off but only under certain conditions. See weight and balance section of this manual.

ENGINE

Continental aircraft engines (A-75, A-80, C-75, C-85, C-90, and O-200), 75 horsepower through 100 horsepower are currently approved for use on the VariEze. Their installation is defined in Section IIA of the manufacturing manual.

Also approved is a stripped-down, 215 lb version of the Lycoming O-235. Installation of this engine is defined in Section IIC.

240 lbs is the maximum weight of engine, prop, prop extension, exhausts and spinner. This weight is the maximum allowable vibrating mass and does not include engine mount or cowling. Maximum engine and accessory weight is 215 lb.

PROPELLER

The VariEze uses a two-blade, fixed-pitch, modern wood propeller with plastic leading edge protection. The modern wooden prop provides efficient thrust, minimum weight, low cost, and fatigue-free service. Many propeller configurations have been evaluated on the VariEze. The 75 hp prop is somewhat of a climb prop. The others listed, are more optimized for maximum cruise performance.

ENGINE	RATED RPM	PROP DIA. & PITCH	PROP EFFICIENCY CRUISE	80KT
A-75	2600	58 x 63	84%	63%
C-75	2275	58 x 70	84%	61%
A-80	2700	58 x 62	84%	63%
C-85	2575	58 x 66	84%	58%
C-90	2475	58 x 70	84%	57%
O-200	2750	58 x 67 or 56 x 70	84%	54%
O-235		58 x 69	84%	53%

NOTE: The above O-200 props have been verified by flight tests. The other props have been calculated by the same method used to design the O-200 props. All the above sized 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.

Note that some of the smaller engines use a prop with more pitch than the O-200 prop. This is because they develop their horsepower at a lower rated RPM.

There is a large variation of performance among the propellers on the market. All data in this manual are based on flight tests with the O-200 using a "Ted's Custom Props" 56 x 70 prop. While other manufacturers no doubt can produce a prop with similar performance, some props tested on N4EZ resulted in significantly reduced performance.

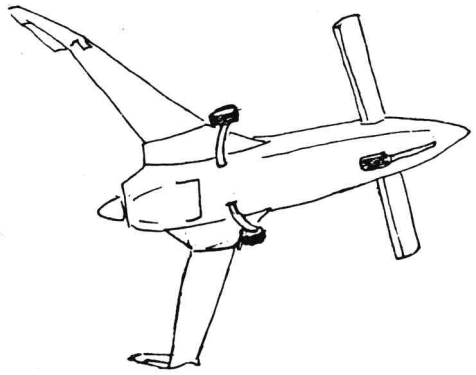
If your prop is the correct size for the engine, the static rpm (fullthrottle, zero airspeed) should be between 85% and 90% of the rated rpm.

LANDING GEAR

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

The main landing gear may use the lightweight, low profile, Rosenhan 5-inch wheels and brakes or the Cleveland 5-inch wheels and brakes. A low-profile tire, size 3.40-3.00-5, is used. Larger tires cannot be used due to gear resonance. The nose wheel is 4-inch diameter and uses a 2.80-2.50-4 tire and tube.

VariEzes equipped with an electrical system should have a buzzer gear-warning system which is actuated at low power settings with the gear up.



COCKPIT

Both front and rear cockpits are exceptionally comfortable. Semi-supine (reclined) seating is provided for optimum crew comfort. Pilots up to 6 feet 6 inches tall and 220 lbs, and passengers up to 6 feet 5 inches tall and 220 lbs will find the cockpit quite comfortable. Pilots 6 foot 3 inches or less, find it easy to seat themselves first and then comfortabley extend their legs forward from the sitting position. Passengers find ample leg room in the rear cockpit. The canard configuration provides a wide cg range which allows for a full-length rear cockpit without the passenger having to straddle the pilot.

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

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

Small baggage, snacks, maps, and navigation instruments may be stored in the front cokpit 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.

The VariEze instrument panel, while not intended to accomodate a complete IFR instrumentaion and radio package, will hold up to eight 3 1/8 inch diameter instruments, four 2-inch instruments and a flat pack 720-channel radio, allowing a complete set of basic instrumentation. The pilot who doesn't care for elaborate instrumentation may opt for larger leg holes, giving easier pilot entry.

Due to the highly insulated fuselage structure and long plexiglass canopy, the VariEze will maintain about 70° F inside temperature with an outside temperature of 10°F (vent closed, sun shining). Thus the requirement for cabin heat is far less than conventional light-planes. Due to the small cabin volume & good vent location the EZ is more comfortable on hot days than conventional lightplanes.

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

FUEL SYSTEM

The fuel system consists of two wing tanks and a small fuselage tank, all equipped with visual sight gauges. A three-way selector is located on the pilot's right console. The selector is positioned left to select wing fuel, up to select fuselage fuel, and right to off.

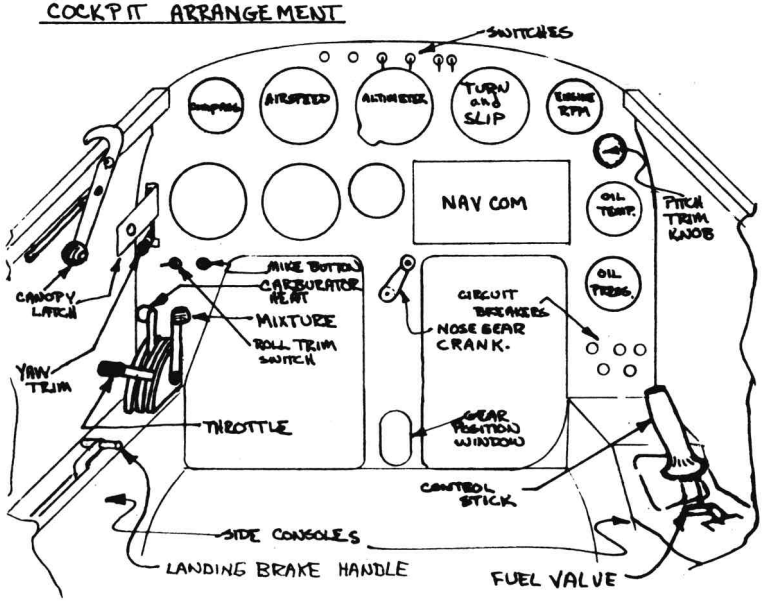
The wings hold about twenty-four gallons total, all is usable for climb or level flight. One to two gallons per tank are not usable for steep descents. The fuselage tank holds about 2 gallons, all is useable in all normal attitudes.

Drains are provided at the wing tanks and at the fuel valve (system low point). The wing tanks are vented together to maintain equal tank fuel levels. The fuselage tank has separate vent to provide redundancy from a clogged vent. The fuel selector handle is designed to interfere with the pilot's wrist when the fuselage tank is selected, as a reminder to not takeoff on fuselage fuel. Fuselage fuel is to be used last. This allows complete use of the wing fuel and if necessary a very accurate indication of the last ½ hour fuel supply in the 2 gallon fuselage tank.

CAUTION

Fuel additives should be checked for compatability prior to use. Some fuel additives such as MEK or deicing fluids "Canned Heat" will dissolve the epoxy in the fuel tanks and should not be used. Auto gas,especially the high aeromatic content no-lead, should not be used.

COCKPIT ARRANGEMENT



CONTROL SYSTEM

Pitch is controlled by a full-span canard slotted flap providing a large allowable cg range. Roll is controlled by conventional ailerons on the rear wing. The cockpit controls are similar to most aircraft with pitch and roll controlled by the side stick and two rudder pedals for yaw. The side stick controller is employed to give the pilot the smallest workload control arrangement possible. The rudders, located on the winglets at the wing tips, operate outboard only, providing two totally independent systems. The rudders are used singly for yaw control or can de deployed together as a mild speed brake.

BRAKES

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. This system aids in keeping brake maintenance low by insuring that full aerodynamic control or braking is employed before wheel brakes are applied. A parking brake is provided on the left wheel. The principal parking brake is provided by the rubber bumper on the nose gear (nose-down parking). The wheel parking brake is utilized only for very brief periods while the pilot enters the aircraft with the nose gear extended.

TRIM SYSTEMS

Cockpit adjustable trim is provided about all three control axes. Bungee trim is provided in pitch, adjustable by a panel-mounted knob. Yaw trim is provided by offsetting the left rudder stop with an instrument-panel mounted lever (this control doubles for parking brake when pulled to the extreme position). Roll trim is available to offset trim changes due to engine power, as well as homebuilder construction tolerances in the wing twist. The three-axis trim allows hands-off flying by providing precise trimming. The aircraft can be flown safely and landed with any trim at any position, providing safety from a jammed or runaway trim system.

LANDING AIRBRAKE

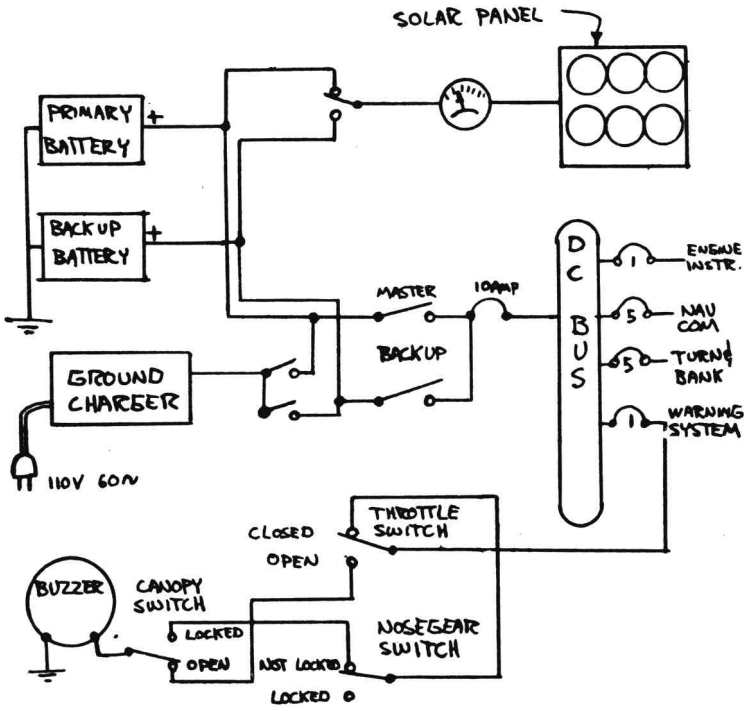
Most VariEzes incorporate an optional drag device intended to allow a steeper approach and to provide more deceleration in the flare. This belly-mounted "speed-brake" is deployed by a lever on the left console. It is normally extended on downwind after gear extension and left down until after landing. Maximum speed with the airbrake down is 90 kts. (105mph). Above 95 kt (110 mph) the brake automatically closes. The brake does not affect trim, stability, stallspeed or stall characteristics. The awkward position of the brake handle in the deployed position aids in reminding the pilot that the brake is down if he forgets it on his takeoff checklist. Climbs should be avoided with brake down, as cooling and climb rate are reduced. The brake induces a mild buffet when down.

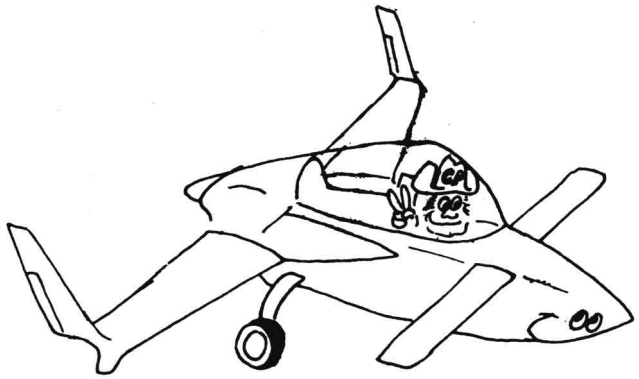
ELECTRICAL SYSTEMS

The preferred electrical system is the lightweight one, without alternator. A small 7-lb battery is used to operate the NAV COM, engine instruments, roll trim, gear warning and a standby turn and bank gyro. The battery can be charged while on the ground with a charger or can be charged with a four watt solar cell panel.

If you are using a system without the alternator you must conserve electrical energy by using the radio and gyro only when needed. The airplane is cruised with the master switch off (no electrical drain) while the solar panel recharges the battery. The solar panel is always on, trickle charging the battery whenever it sees sunlight. Systems without the alternator normally have a small backup battery that can be selected if the primary battery runs down.

Electric engine starting is not used on the VariEze due to the high weight of the needed starter, large battery and heavy wire.





NORMAL OPERATIONS

This Section covers the normal operating procedures for the VariEze. A summary checklist is also provided for more convenient cockpit use. Detailed loading information and performance data are provided in later sections of this manual.

PILOT POSITION

The VariEze was designed to accomodate tall pilots up to 6 ft. 9 in. or 6 ft 6in in comfort. Short pilots can fly the aircraft but they must sit on cushions to position their eyes in about the same position as tall pilots in order to have adequate forward visibility. The adjustable rudder pedals should be set in the aft position for short pilots and they sould use cushions primarily under them, not behind them. If a short pilot uses a large cushion behind him, he will bepositioned forward and down because of windshield clearance and have inadequate forward visibility during climb and landing flare. Confirm that your head is within 1" of touching the canopy before you take off.

ENGINE START

Engine starting is accomplished by hand-propping. While you have doubtlessly been horrified by the accident statistics on hand-starting antique aircraft, remember that the VariEze is a totally different story. Antiques are generally tractor aircraft, which means that they tend to chase you, once started. VariEze's, on the otherhand, 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 VariEze, with nose-down parking, chocks itself, and the pusher prop blows you away from danger. With modern, impulse-coupled

magnetos, it isn't necessary (or desirable) to make a Hurculean pull of the propeller for starting; just pull the engine up on compression and give it an Eze flip through. In the unlikely event that your VariEze does run away from you after starting (if you leave the throttle open), it won't carve the first thing it comes to into hamburger, but will give it a bump with the nose instead. Note also that on a tractor installation, you have to reach through to the back of the prop to grab it. On a pusher, you hold the prop on the face nearest you. For engine starting the aircraft should be parked nose down on the bumper.

Be sure your carburator has an accelerator pump for automatic priming. Starting can be difficult without one. Eventhough the VariEze is much less susceptible to runaway during hand propping, it is still a good practice to have someone tend the throttle and switches during starting.

COLD START
- Pump throttle once or twice
- Mags OFF
- Pull engine through one or two blades.
- Mags ON
- Grab prop about 1 ft from tip; pull down onto compression, and give prop a smooth flip.
- Repeat as necessary. If the engine doesn't start after five or six pulls see flooded start procedure or very cold conditions procedure.

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

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

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

After start, the engine should be idled at 800-900 rpm. Oil pressure should rise to 20 to 35 psi within 45 seconds.

Note - If you have less than 1/2 wing fuel, the engine will not feed fuel in the nose down parking position. This does not effect normal operation since the engine will idle almost 2 minutes with the fuel in the carburator. If you want to run the engine longer while parked nose down, select the fuselage tank.

TAXIING

Have your passenger board and strap in while the aircraft's nose is still on the ground. Long-legged types may step directly into the rear cockpit. Shorter passengers can step into the front seat first, then into the rear cockpit. With your passenger aboard, set the parking brake, raise the nose by lifting at the canard leading edge. Crank the nose gear into the extended position and enter the cockpit by swinging your leg over the side or using the kick-in step. Be sure that the parking brake is engaged while you climb into the cockpit. If not, the airplane can roll forward if you're parked down hill or the engine is not idling slowly.

Steering below 25 knots (30mph) 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 you to rudder steering as the rudders become increasingly effective. The nose gear will free swivel, enabling you to maneuver in very tight places with ease. At low speed, steering is done exclusively with differential braking. The geometry of your VariEze makes it much less sensitive to upset than most aircraft; comfortable taxiing operations have been demonstrated in 40 knot crosswind components.

CAUTION

When taxiing with the canopy open, be careful that the wind doesn't slam it closed on your fingers!

TAKE OFF

Complete your pretakeoff checklist. Double-check that your canopy is locked down. Taxi forward a few feet to straighten the nose gear. Pitch trim should be set slightly nose up (a light force on the stick).

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 45 knots or 52mph) and hold the nose wheel just clear as you accelerate to about 60 knots (69mph). As you pass through 60 knots, rotate smoothly and you'll be off and flying. Use 65 knots (75mph) at heavy gross weight. Hold aileron into a cross wind as you rotate to lift-off.

HIGH DENSITY ALTITUDE: At density altitudes above 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 knots (75 mph), then smoothly rotate and lift off.

ROUGH FIELDS: Rough or gravel fields are not recommended due to heavy gear loads and the possibility of prop damage. If you must take off from a rough field, use full aft stick to get the nose gear off as soon as possible. Maintain a nose high attitude and let the aircraft fly off at about 58 knots (65mph); 53 knots at light gross weight.

CAUTION

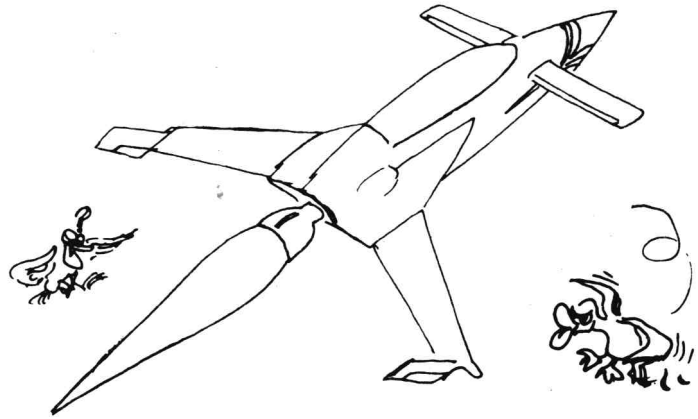
Never rotate the nose beyond the angle that places the canard on the horizon.

CLIMB

Climb performance data is given on page of this manual. For optimum rate of climb, maintain 84 knots (96mph). Best angle of climb is obtained at 70 knots (80 mph). For better visibility and improved cooling, a normal cruise climb of 85 to 100 knots (100 to 115 mph) is used. Climb performance is improved with the nose gear retracted, although not drastically and it should be retracted once your initial climb is established.

NOTE

A standard non-turbocharged VariEze (N4EZ) attained an altitude of 25,300 ft in November 1978.



CRUISE

Maximum recommended cruise power setting is 75% for the Continental engines. A high cruise power setting will result in speeds as shown on pages and . However, to take the best advantage of range and fuel economy, you may find that cruise power settings as low as 45% get you to your destination faster by avoiding fuel stops. Cruise at 60% power is the best compromise, providing good speeds and a significant lowering of engine noise over 75% power. Lean your fuel mixture for best ecomony at cruise.

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

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

Check the fuel level in each tank occasionally. If you are cruising in a side-slip (one wing low), fuel will transfer to the lower tank. If this occurs, reset the roll and yaw trim to level the aircraft. If, due to clogging, failure of vent lines, loss of a fuel cap, etc., the two tanks do not read the same, you must assume that the engine may quit when the first tank runs out of fuel. Under normal conditions the tanks will read within one to two gallons of each other. If they do not, sideslip with the fullest tank high, to level the fuel readings.

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

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

When flying in visable moisture (rain) a VariEze will experience a pitch trim change. Some VariEzes climb, some descend. The forces are mild and can be over come with trim or stick pressure. These trim changes increase with increased speed. A heavy nose-down trim change has been reported in a high speed descent in heavy rain.

DESCENT

You will find that your VariEze has such good climb performance that you routinely use higher cruising altitudes to avoid turbulence discomfort more often than with most light aircraft. Bearing this in mind, you want to plan your descent into your destination enough in advance so that you don't find yourself over your destination with 10,000 ft of altitude. The VariEze is a clean airplane and even with power at idle it may take 10 minutes to land! Using the extra altitude

for a cruise descent speed advantage will get you there a lot sooner Don't forget to richen mixture when descending below 7000 ft. You will need to reset roll trim for the descent when power is reduced.

If a long normal descent is made with less than one gallon of fuel in each wing tank, fuel starvation may occur. Fuel flow can be regained by selecting the fuselage tank or by reducing descent angle. Starvation can occur during long steep descents with two gallons per wing tank. Because of this possibility, the fuselage tank should be selected for all descents and landings, with less than two gallons per wing tank.

LANDING

Make your approach and traffic pattern very cautiously. Most pilots and controllers are accumstomed to looking for more conventional aircraft of gargantuan proportions (like Cessna 150's) and may ignore you completely. Best pattern speed is 80 to 90 knots (90-105mph) slowing to 70 knots (80 mph) on final approach (75-80 knots in turbulence or gusty winds). The VariEze is a very clean airplane and you can double the runway length required if you are 10 or 15 knots fast on your approach.

Make a complete flare and touch down at 55 to 60 knots (63-69 mph). The normal landing technique of holding the nose off to minimum speed should not be used in a VariEze. Make a complete flare, then fly it down to touchdown. Doing a "full stall" landing will result in inadequate forward visability and the possiblility of striking a wingtip on the ground. That technique will also extend total landing distance and make the landing more difficult. Maintain a slightly nose high attitude as you roll out and use aft stick to ease the loads on your nose wheel during heavy braking. While the landing gear is strong enough for rough surfaces, the small tire diameters will give the crew a harsh ride. This, combined with the 55 to 60 knot (63-69 mph) touchdown speed, makes a hard surfaced runway much more pleasant. If you need to land on a rough field, hold the aircraft off to 55 knots (any slower and you can't see over the nose), keep the nose high as long as possible.

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

Crosswind landing may be flown several ways. Mild cross winds are easily handled using the wing-low sideslip approach. Another method is to simply land in a wing's 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 (no sideslip) and straighten the nose with the rudder immediately before touchdown. The VariEze has demonstrated taxi takoffs and landings in gusty winds to 45 knots and with crosswind components as great as 20 knots. See forward sideslip caution, page .

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

LANDING GEAR SPEEDS

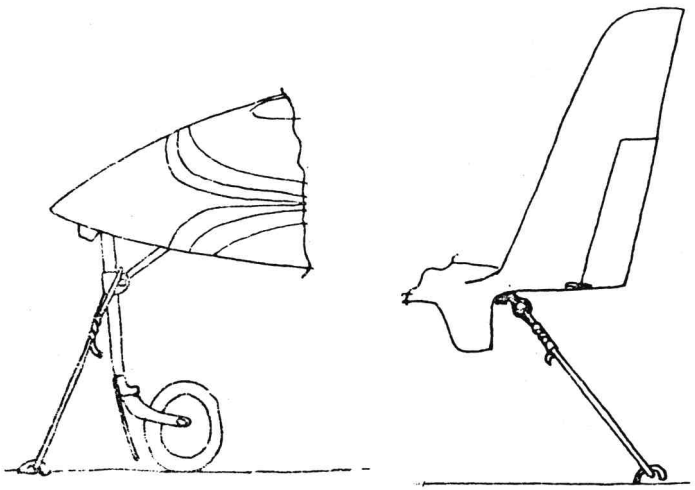
Don't extend gear above 120 knots (138 mph) at higher speeds the airloads make it hard to extend. The gear can be down or can be retracted at speeds up to 140 knots (163mph).

TIE DOWN AND GROUND HANDLING.

The VariEze can be left unattended on the nose bumper in moderate winds. For long term parking, extend the nose gear and tie the airplane down as shown with the nose directly over what is normally the tail tiedown. Tie the nose securely so that it can't move up, down, sideways, fore, or aft. Tie the wings as shown using the tiedown rings through the hole near each winglet.

Normal care of the main landing gear should always include lifting one wing tip to allow the gear to spring inward when parking, especially in hot weather. This reduces the possibility of gear creep and loss of alignment. Gear creep should not occur unless the airplane is overweight.

Also brief all ground handlers that VariEze's can fall on their tails unless parked nose down.



LOW SPEED HANDLING AND STALL CHARACTERISTICS

The VariEze has good flight characteristics at minimum speed. It is a docile, controllable airplane at full aft stick at its minimum airspeed of 46 to 49 knots. It doesn't exhibit any of the conventional airplane's tendencies to roll or pitch down uncontrollably or other common uncommanded flight path excursions. Any power setting 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 range (below 52 knots) is characterized by a doubling of the force required to hold the stick aft, tending to keep the inattentive pilot at a more normal flying speed. Ailerons and rudder are effective at all speeds including full-aft stick flight.

Since the flight characteristics of the VariEze are so much better at minimum speed than contemporary conventional aircraft, it hardly seems fitting to use the term "stall" in characterizing the Eze's behavior, even though it is technically correct. The VariEze's "stall" consists of any one of the following in order of prevalence:

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

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

3. Occasionally, particularly at aft cg, the airplane will exhibit an uncommanded Dutch-roll, a rocking back and forth of the wings in roll. The rock if is exists, will be mild and sometimes divergent, reaching a large roll (30° bank) by about the fourth or fifth cycle. The "wing rock" should be stopped immediately by relaxing off the full aft stick stop. Prolonged divergent wing rock can result in a uncontrolled roll-off and altitude loss.

At any time during the "stall" power can be set at any position, or slammed to full or idle, without effecting the stall characteristics. There is a small roll trim change due to power and a very slight pitch trim change; neither effect the aircraft's controllability at sustained full aft stick.

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

Intentional spins have been attempted by holding full aft stick and using full rudder, with all combinations of aileron control, and at all cg positions. These controls were held through 360 degrees of rotation. Full aft stick and full rudder 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 immediatley stopped by removing rudder control and a completely straight forward recovery can be made. That maneuver is not a spin, since at no time is the aircraft departed from controlled flight. If the above maneuver is done at aft cg, the rotation rate is higher so the lazy spiral is more of a slow snap roll. However, even at aft cg the recovery isimmediate when controls are neutralized.

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

CAUTION - Avoid aggravated full-rudder, cross control side-slips at low altitude. The VariEze is departure-free at full-aft-stick stall speed. However at higher speeds the rudders become more effective and a large enough sideslip angle can be generated to stall a winglet. If winglet stall occurs at the same time a roll rate is being generated in the opposite direction eg, full right rudder and full left aileron, the aircraft can depart controlled flight. Departure is evident by an uncontrolled yaw and roll. Recovery is normally prompt when controls are neutralized, however if yaw is extreme, the air-

craft may rotate for several seconds and experience negative g. Use neutral controls until recovered (rotation stops). Total altitude loss in an extreme departure can be as much as 1500 ft.

EMERGENCY PROCEDURES

FIRE

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

ENGINE FAILURE

Modern aircraft engines are extremely durable and seldom fail catastrophically without plenty of advance warning (lowering oil pressure, excessive mechanical noise, rising oil temperature, etc.). Pilot induced failures, on the other hand, are far more common (carburator ice, confusion of mixture and carb heat controls, fuel starvation, etc.). In the event of inflight engine stoppage, check mixture - RICH, fuel - switch tanks, magnetos - BOTH, and attempt restart. If the engine begins to run rough, check for induction icing, improper mixture setting, or a bad magneto. If carburator heat or an alternate magneto setting fail to correct the roughness, make a precautionary landing as soon as possible and trouble-shoot. Lowering oil pressure, rising oil temperature or increasing mechanical noise are good indications of impending failure and flight should be aborted as fast 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.

At normal approach speeds, 70 to 85 knots, or higher, the propeller will windmill. This windmilling prop will enable you to restart, provided the cause of the initial failure is corrected. The prop will windmill down to 60 knots (70mph), but once stopped you must accelerate to 130 knots (150mph) to start it windmilling again. The high-compression Lycoming O-235 should windmill down to about 70 knots. But once the prop is stopped it takes 160 knots or more to start rotation.

If engine failure occurs when there is less than one gallon of fuel in one or both fuel tanks, or during a long, sustained, steep descent with low fuel (less than two gallons in each tank), the most probable cause is fuel starvation. Select fuselage tank. If wing fuel starvation occurred during descent, the wings may have one to two gallons of fuel that is stilluseable during level flight or climb.

ENGINE OUT APPROACH

If an engine-out landing is unavoidable, check wing direction, choose your landing area and establish your glide at 80 to 85 knots. Gliding performance is shown on page . Remember that with the engine out and prop windmilling, your glide will be considerably steeper than the normal engine-idle glide that you are accustomed to. If you are radio equipped, tune in 121.5 and declare an emergency and give your intended landing site. Shut off the fuel valve. Your landing gear should be down, even for an off-airport landing in rough terrain, or water. Your glide will be steepened and rate of descent increased with the gear down. Turn you electrical power and mags off before touchdown to minimize any potential fire hazard. Touchdown as slowly as possible if landing in rough terrain.

INFLIGHT CANOPY OPENING

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

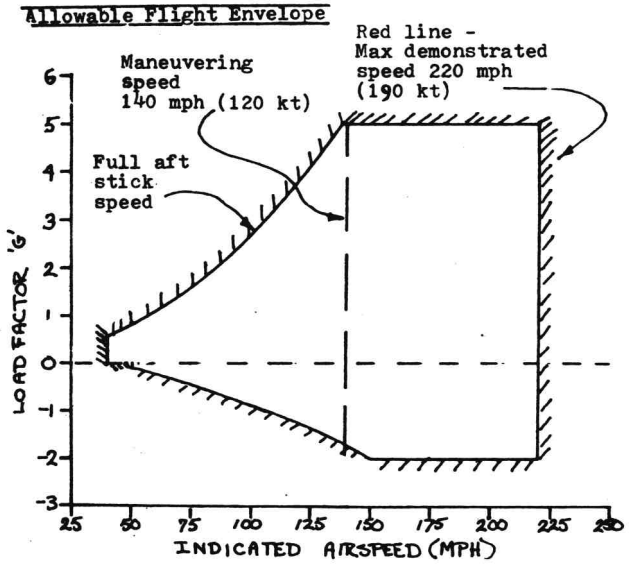
Should the canopy come fully open 90° in flight immediately grab the canopy rail/handle and pull the canopy down. Be sure to maintain aircraft control. The aircraft is controllable and can be landed safely with the canopy being held down against the fingers.

Remember to maintain aircraft control. Don't 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 stall and the nose dropping hard to the runway.

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



PLACARDS

Max gear extension speed, 120 knots (138 mph)
Max speed with gear down 150 knots (172 mph)
Aerobatics are not permitted.
Intentional spins are not permitted.
Caution: Avoid aggravated full-rudder, cross-control side-slips at low altitude.
Maximum crosswind component for take off/landing - 20 knots (25 mph)
Maximum wind for taxi (all quarters) - 45 knots (52mph)
Weight and balance - see page.
Red line speed 190 knots (220 mph)
Maneuver speed 120 knots (140 mph)

PILOT EXPERIENCE REQUIREMENTS
PILOT CHECKOUT

There is no such thing as a minimum number of hours a pilot should have, to be qualified for checkout in a single-control aircraft. The best pilot qualification is variety. He should be current in more than one type of airplane. The VariEze is not difficult to fly, but it is different: like a Yankee is different from a Cessna, or a Cub is different from a Cherokee. A pilot who is used to the differences between a Cessna and a Cub is ready to adapt to the differences in a VariEze. The VariEze has entirely conventional flying qualities. However, its landing speed is 5 to 15 knots faster than most light planes and should not be considered as a training airplane to develop basic flight proficiency. The VariEze ranks with the best tricycle-geared types for ground stability and has none of the ground-looping tendencies of the taildraggers.

The requirement for a variety of experience applies to checkout in any type of new aircraft,not only to VariEzes. RAF has never experienced a problem in checking out a new VariEze pilot. We always follow the following criteria for initial pilot checkout and strongly recommend that you do.

1. Checkout should not be done in gusty winds, particularly crosswind conditions.
2. Use runway at least 3500 ft long for initial checkouts. The beginning VariEze pilot often finds himself fast on approach and the airplane is so clean that it is easy to use up a lot of runway in the flare.
3. Give the pilot a backseat ride or two. This gives him a first-hand look at the aircraft's performance envelope and general flying qualities. Trim the airplane up and let him "fly" it from the back seat by leaning back and forth. This will give him an appreciation of the airplane's natural stability. Show him the use of all three trim systems, (pitch, yaw and roll). Let him get used to the pitch and roll feel by flying the rear stick control.
4. Have him fly solo on his first flight. The airplane is easier to fly at lighter weights.

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

If you think you have over-rotated, do nothing; don't shove the stick forward, the airplane will not stall. Hold the liftoff attitude and the airplane will accelerate to 80 knots for climb.

Occasionally a new VariEze pilot will tend to make a "full stall" landing or flare too high. Tell him that if he has made the approach at the correct speed (70 to 75 knots, 80 to 85 mph), and pulls power to idle before the flare, he should not spend a lot of time in the flare. Make a complete flare, then drive the airplane down onto the runway; don't hold it off extensively. This may result in a touchdown speed of 60 to knots, but is preferable to flaring too high or slowing to less than 55 knots where forward visibilty is poor and the possiblity of dragging a wing tip may exist. For further information on checkouts, refer to flight test procedures, Appendix II.

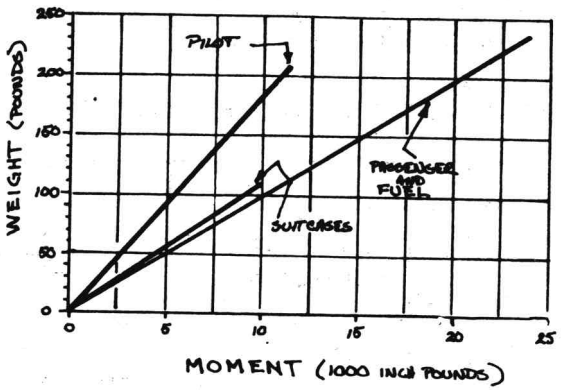
WEIGHT AND BALANCE

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

Add up the weight and moment totals for your load as shown in the sample problems. Then divide the total moment by total weight, to get the loaded cg position fuselage station (inches aft of the datum; F.S.0.00). For the light pilot sample, total weight is 798 lb.total moment is 80,295 inch pounds, and the loaded cg is 80,295/798=100.6 inches aft of F.S.0.00 or F.S. 100.6. The chart shows this weight and cg position to be inside the acceptable flight envelope as shown (page **26**).

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

Where: Empty moment is determined by weighing (see page **31**).
Pilot moment = pilot weight times 59.
Passenger moment = passenger weight times 103
Fuel moment = fuel weight times 103
Fuel weight = fuel gallons times 6.0.
Total weight = empty weight (weighing, page **31**).
+pilot + passenger + fuel.



Sample loadings

Light pilots / Heavy Pilot

Item	Wt.	Sta.	Moment.	Weight	Sta.	Moment
Empty A/C	535	110.0	58850	535	110.0	58850
Oil	8	140.0	1120	8	140.0	1120
Fuel	120	103.0	12360	30	103.0	3090
Pilot	135	59.0	7965	210	59.0	12390
Pass-enger	-	-	-	210	103.0	21630
Baggage	-	-	-	50	80.0	4000
Total	798	100.6	80295	1043	96.9	101080

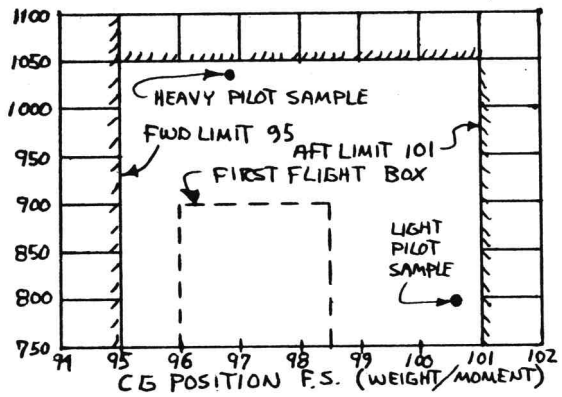
YOUR AIRPLANE.

Item	Weight	Station	Moment
Empty A/C			
Oil		140	
Fuel		103	
Pilot		59	
Passenger		103	
Baggage		80	
Total			

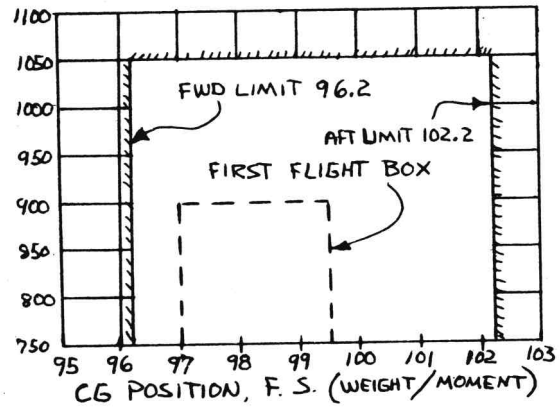
NOTE

Without wing cuffs (see Canard Pusher #19) revise aft cg limit to FS 100.5 (short canard) and FS 99.5 (Standard canard).

C G LIMITS.
STANDARD CANARD 150 INCH SPAN WITH CUFFS.



C G LIMITS
SHORTENED CANARD 142 INCH SPAN WITH CUFFS.



Note: max gross weight limitations of 1110 lbs is allowable under certain conditions see page 32 of this manual.

APPENDIX I

INITIAL SYSTEMS CHECKOUT

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

General

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

Canard incidence = Zero ± 1° (Use canard incidence template B, Section I, page 4-15)

Wing incidence Zero ± 1° Wings must be within ½° incidence of each other. (Use wing incidence template, Section I)

Rudder travel = 2.1" ±.1 Measured at the top of the rudder at trailing edge. Measure this with pilot holding full rudder pedal while someone applies a 5 lb force inboard on the rudder trailing edge, to take any "slack" out of the system.

Elevator travel = 22°±2° Trailing edge down.
20°±2° Trailing edge up.

Ailerons must both fair into wing at trailing edge when neutral. At full deflection aileron T.E. must travel 1.9" ± 0.3" at outboard end (measure relative to wing T.E.)

NOTE

Seat belt/buckle obsolescence. Make sure the lap belt/buckle is not the series E8000 manufactured by EON Corporation. This buckle is not airworthy and should not be used. Also insure the seat belt brackets are radiused where the nylon belt loops go through. Radius any sharp edges to avoid cuts in the strap.

NOTE

Insure that the elevator control system push rod has had the small HM-3 rod ends replaced with the larger HM-4 ends. See Canard Pusher # 20.

Control System.

'Check that canopy sponge seals are in place and that canopy locking handle is adjusted so it must be forced hard forward to lock. This is extremely important to eliminate any possibility of it being bumped open in flight.

'Elevator and aileron pushrods for proper installation (spacers, washers, bolts, locknuts, clevis pins, and safety clips, installed properly).

'Elevator and ailerons pushrods for freedom of movement throughout control travel.

'Pitch, roll and yaw trim mechanisms for proper function, and freedom of movement.

'Elevator and aileron hinge attachment screws for security and jamb nut installation.

'Elevator and aileron for freedom of movement throughout range without binding or chafing.

'Rudder pedals for freedom of movement, cable attachment, and positive return to neutral.

'Rudder pulleys for free rotation and cable guard installation (the four cotter pins on the pulley brackets).

'Cable clearance throughout control travel.

'Brake actuating cable freedom.

'Adjust rudder trim for neutral left rudder.

'Elevators for proper mass balance - 10° to 25° nose down. Weight evenly distributed between inboard and outboard locations.
'Ailerons for proper mass balance - level to 10° nose down.
'Check for 1/16" minimum clearances around all mass balances. Binding can occur at elevated load factors if clearance is too small.

Landing Gear

Main Gear—

'Double check that all attach bolts and axle bolts are installed and secured.
'Check tires for proper inflation pressure (mains 55 to 65 psi, wait 24 hours and see if they leak).
'Adjust brakes and test for proper function. Service with fluid as required. Bleed by flowing from drain up to master cylinder. Recheck rudder travel 2.1"+ .1

'Double check for proper main tire toe-in (zero to two degrees toe-in).
'Main gear bearing packed with grease and safetied.
'Brake mechanism for safetying.

Nose Gear—

'Nosegear tire inflation, 40 psi.
'Bearing for grease.
'Axle nut for security and proper installation.
'Shimmy damper for friction adjustment (three to five lb side force at axle is required to rotate pivot).
'Check safetying and security on all actuating mechanism hardware.
'Light grease on worm and wormgear.
'Hold nose up and cycle gear to verify proper function and locking. Verify an over center condition on the NG50.
'Verify nose gear warning micro switch is activated in last 1/10" of NG 50 travel.

Instrumentation

'Cylinder head temp -
'Oil temp. - It's important these two gages be accurately calibrated prior to use. This can be accomplished using hot oil and a high-temp candy thermometer.

'Exhaust gas temp.
'Pitot/static systems - leak check
'Oil pressure
Tachometer - } Function check on initial engine run.

Powerplant

Check -

'Clock the prop for compression at the 10 o'clock position for proper hand-propping.
'Propeller bolts for proper torque (180 inch-lb) and safetying.
'Propeller for proper track (within 1/8")
'Spinner track and cracks.
'Engine mount bolts for security and safety
'Oil level.
'Mixture, throttle, carb heat controls for security and proper function.
'Magneto wiring. Be sure the mags are cold when the switches are off.
'Check that the magneto impulse coupling clicks at, or after, top dead center.
'Cowling baffles must fit tight all around the engine and cowl. If not, oeverheating will result.

FUEL SYSTEM

'Check that the fuel caps seal securely and the vent system is clear without leaks.

'Flow check your fuel system by removing the fuel inlet line at the carburetor and using a stop watch and a bucket to measure fuel flow; make two measurements, one with the aircraft level (W.L. 23) and one with the nose up about 5 degrees. Nose-up fuel flow should be 15 gallons per hour (1 quart in 1 minute) minimum with 2 gallons in each tank. With the airplane level, it should feed 10 gph (1 quart in 90 seconds) minimum with 2 gallons in each tank. These fuel flows are adequate for the 100-hp Continental. If your fuel flow is less than these minimum values, check your system for obstructions. Lower the aircraft's nose. Now, raise the nose to a level attitude and remove the line from the carburetor. A 10-gph minimum flow should commence within 15 seconds with only 2 gallons in each fuel tank.

'Check your fuel emergency shutoff for proper function. After flushing the entire fuel system check your fuel filter and carburetor filter (at carb inlet) for contamination.

'Calibrate your fuel gages with the aircraft level. If the fuel doesn't read clearly, sand the gage area to a very smooth surface with 220 sandpaper and paint on a coat of clear epoxy (RAEF).

'Check freedom of fuel valve. If it requires more than 5lb force at handle the valve must be overhauled. CAUTION - if valve is selected between wings and fuselage position, the fuselage tank will drain into the wings.

WEIGHT AND BALANCE

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

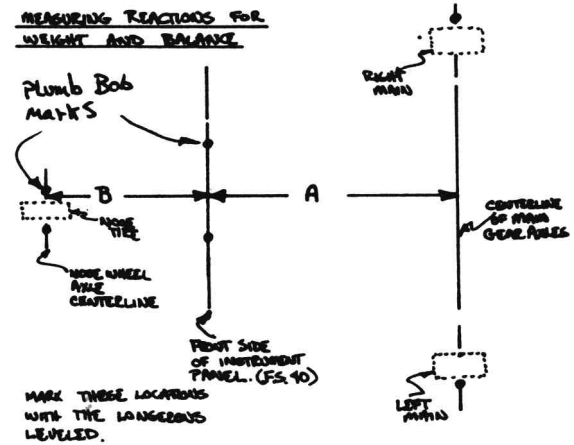
Equipment required: three scales - platform type are nice, align the scales or use grease plates to avoid side loading scales. Bathroom scales can give inaccurate readings and should not be used. You need a level, a 12 ft decimal tape measure, a plumb bob and line, chalk to mark on the hangar floor,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

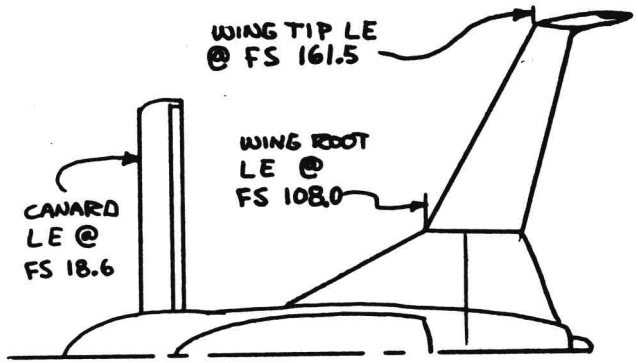
Position the airplane on the scales with the W.L. reference (top longeron) level. Put the ballast in the front cockpit along the instrument panel (F.S.40) where your legs go through. Record the scales readings with the airplane alone (no fuel, no pilot, no baggage). Next, with the aircraft off of the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

your airplane out of the way and take the measurements shown below: Do not omit this step.

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

When loading the aircraft for the initial flight testing it is important that the weight and cg fall in the first flight box (see page 26) However if a choice of one must be exceeded , an overweight condition is preferable to an aft cg condition.





To get the moment arm (fuselage station) of your main gear, add dimension A (in inches) to 40.0 (it should be about F.S. 107.0). To get the nosegear arm, subtract dimension B (in inches) from 40 (it should be at about F.S. 20). Be sure to weigh and record the ballast weight and next make a tabulation as shown.

ITEM	GROSS	TARE	NET	ARM	MOMENT
R.MAIN	276	-1	275	108.0	29.700
L.MAIN	278	-2	276	108.0	29,808
NOSE	8	-1	7	17.0	119
BALLAST	-25	0	-25	40.0	-1,000
TOTAL			533	110.0	58,627

Divide total moment by total net weight (58,627/533) to get empty cg (110.0). Remember that you have to subtract the weight and moment of the ballast.

Now, record the empty weight and moment (533 and 58,627 in the sample above) for your airplane on the table on page . Determine (trial and error) the maximum pilot weight with zero fuel and no passenger, which will stay inside the envelope on page . Do the same for the lightest pilot using your empty weight and moment, full fuel, and no passenger. Once these weight limits are determined, placard your aircraft accordingly. As an example the placard can read:

Front Seat Pilot Weight Limits	
Maximum	210
Minimum	128

If you desire to raise or lower the range of allowable pilot weights, you may do so by moving the battery or adding ballast, or by trimming the canard to 142" span. See newsletter #14 for details on trimming the canard.

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

NOTE: A maximum gross weight of 1110 lbs may be used, but only under the following limitations:

1. At least 90-hp engine
2. Taxi and takeoff only on smooth, hard surface. Use 65-psi tire pressure on mains; 75-psi if 4-ply tires are used.
3. Maximum weight for landing limited to 1050 lb.
4. Maneuvers limited to normal category +4g, -1g. No intended abrupt maneuvers.
5. Add 300 feet to gross weight takeoff distance, liftoff at 70 knots (80mph) climb at 85 knots (98mph)
6. Pilot proficiency - at least 50 landings in VariEze before attempting overgross operations.
7. High gross weight should not be considered for routine operations, since the chances of surviving an off-airport forced landing diminish rapidly as weight is increased.

CAUTION

To operate your VariEze in an overweight condition is a high risk acitivity and an extremely hazardous practice.

APPENDIX II
FLIGHT TEST PROCEDURES.

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

Too many people do a professional job of building their airplane than lose everything because they do a non-professional job of flight testing. If some thing is not quite right fix it before you fly. Be sure your pilot proficiency is sharp and current.

Ground Testing

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

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

Low Speed Taxi

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

Refer to "pilot position" page 10 , to set up the seat for correct visibility. Low speed taxi is defined as that slower than required to lift the nose wheel off the ground - 35 knots (40mph). Spend at least a full hour doing low speed taxi to fully 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 taxiing can overheat the brakes. At 35 knots you will note that the floppy feel of the control stick is gone and airloads now provide a comfortable centering feel.

Recheck that your weight and balance is within the "first flight" box on the diagram on page . Recheck wing and canard incidences and control travel and freedom before proceeding. Now is the time for the final FAA inspection and issuance of your airworthiness certificate (see Section I, page 1-5).

High Speed Taxi/Liftoffs

Before conducting the following tests with your new VariEze, do all of them first with two other different Airplanes in which you are proficient. These maneuvers (nosewheel liftoff and runway flying at low power) are a little strange to the average pilot. Doing them in a familiar airplane takes the strangeness out of the maneuver and better prepares you to do them in a new airplane. It also gives you a first hand look at runway length requirements and wind conditions.

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

- -Weather - wind calm or smooth wind straight down the runway. Smooth air - check turbulence in another airplane.
- Runway - at least 4500 ft, preferably over 6000 ft
- Fuel - fill each tank about half full.
- Pilot - see pilot experience requirements - page 23 for absolute minimum criteria. Do not test fly a new airplane while fatigued: go home, get some dinner, sleep, you're more alert in the morning.

The reason for the long runway requirement is to allow you to do liftoffs and landings without going around. This allows you to check for gross out-of-trim conditions without having to fly very high. The air must be smooth and without crosswind to allow you to check the aiplane's trim during a brief lift off. Set the pitch trim for a light nose up force (aft stick force of 1-2lb). Set neutral roll and yaw trim.

First, make several runs down the runway at aim airspeeds of 40 knots (45mph), 45 knots(52mph), 50 knots (58mph), 55 knots(63mph), and 60 knots(69mph). Do this by accelerating to the aim speed, reduce power (to near idle) to maintain the aim speed. While stabilized at the aim speed lift the nose wheel slightly off the ground, reduce power and brake to a stop holding the stick back to relieve the nose gear. While the nose gear is off the ground, check directional and pitch control, and rock the wings with aileron control to

get the feel of roll response. You should have enough elevator power to raise the nose at 50 knots (58mph) and keep it up while decelerating through about 45 knots (52mph).

When you've done enough runs down the runway so that you can comfortably, smoothly, and easily control the pitch and yaw, you're ready for a lift-off. The lift-off is a brief flight, a few feet above the runway, to final check pitch, yaw, and roll trim and controllability before first flight. Accelerate to about 70 knots (80mph), reduce power to maintain speed (about 1/3 throttle). rotate to lift off, fly low along the runway, reduce power to idle and fly the airplane onto the runway slightly nose high. Don't do a full stall landing on your first try. At lift-off be prepared to use aileron and rudder to correct any roll due to the airplane being built crooked. If the airplane tends to veer off in one direction, set roll or yaw trim to correct, and make another lift off. During the brief flight, you should ask yourself, "is the airplane out of trim in roll or yaw and do I have plenty of pitch control to put the nose up or down?". More than likely your answer will be, "I didn't notice; I was having too much fun flying". If so, do another lift off until your answers are "yes and yes". Then you are ready for your first flight.

The VariEze does not fly like a Cessna 150 or some other sluggish trainer. The VariEze isa high performance, responsive aircraft with differences. It has a side stick and the pilot should keep his forearm on the arm rest and use his wrist to control pitch. Also, the rudders can both be inadvertently deployed at the same time and the pilot should be careful not to do this in flight.

There are three differences in a VariEze that must be thoroughly understood prior to flight.

1. The non-standard rudder pedals. Beware not to push both at the same time in flight. One will usually be out more than the other producing unwanted yaw. The VariEze rudders are very effective and the yaw generated couples easily to roll. In fact the roll rate will almost double with rudder added to aileron control. Adjust the pedals so your foot does not press the pedals naturally.
2. Pitch over-controlling. The novice pilot will expect the VariEze to handle like the C-150, or whatever, he last flew. The experienced pilot knows that J-3 cubs and Bonanzas handle differently and will make the transition easily. Spend enough time on the runway just above rotation speed but below lift off speed and practice controlling pitch so you can put and hold the desired/selected pitch proficiently. Hold the forearm on the arm rest and control pitch with the wrist only. Do not over-rotate! The highest rotation you should see during this or the later flights is the canard up to but never above the horizon. Better yet, keep it always at least 2 degrees below the horizon

3. Nose high, slow touch down speeds. To avoid this be sure that during takeoff and landing to not rotate the nose above the horizon. On takeoff rotate the nose/canard to just below the horizon. Hold it there and wait for lift off. On landing, fly final and touch down while you can still easily see over the nose. If you cannot see the runway, go around and use more speed next time. You will find that using this techinque you will be a little above the normal minimum touch down speeds. This is okay to be a little fast for your first few landings. Runway length notwithstanding,a hot landing in a VariEze is no problem and is much better than a slow, wing rocking, blind "arrival".

First Flight

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 for initial flight tests. First flight is not intended to demonstrate the capability of your aircraft or of the pilot and should be flown very conservatively. Leave the gear down and landing brake up for your first flight and give yourself one less thing to worry about. Limit your airspeed to a range of from 70 knots (80mph) to 130 knots (150mph), stay over the airport and resist the urge to buzz your observers. Buzz jobs on first flights are done by fools, never by professional test pilots. During your climb out, set your pitch, roll, and yaw trims to trim the airplane for hands-off flight. This will be a handy reminder of trim direction, if the airplane needs adjustment. You will notice a small roll trim change when you reduce the power. The airplane will require more right trim with power off. Limit your first flight to feeling out roll, pitch and yaw

responses and checking engine operation, temperatures, etc. Make your approach at 80 knots (90mph) and make another slightly nose-high landing, leaving full stall landings for later in the test program.

Before first flight clean and flush all fuel screens, gascolator and don't forget finger screens in carb. Also remove and clean out carb float bowl. Check float needle valve and seat for cleanliness.

Envelope Expansion

With first flight completed and any squawks resolved, you are ready to expand your flight envelope. Do not promptly charge out and test fly your aircraft at the extreme cg position and weights shown on page Expand your envelope in small increments. Remember, you have to spend 50 hours in your test area, so put the time to good use and do a professional job of flight testing. Before expanding the weight and cg range shown for initial testing, spend a few hours and become thoroughly comfortable in your piloting tasks. When you feel at home in the airplane, begin your expansion of the weight, cg position, load factor and airspeed ranges. Don't feel obliged to expand into the full ranges shown in the plans and in this handbook. Expand your limitations slowly, and if you reach a point that you feel uncomfortable, stop. The ranges shown are those 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 N4EZ, the VariEze prototype. Minor homebuilder contruction tolerances can effect flying qualities and performance; for example, your aircraft may exhibit less or more stall margin. As with any aircraft, completely determine your stall characteristics at a safe altitude, then operate your aircraft accordingly.

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

Some words of general caution - Wear a parachute for your flight testing. Never leave a squawk unresolved; find and fix problems as you encounter them. Have bunches of fun.

APPENDIX III

Maintenance/Inspection

Composite Structure

The VariEze is painted with a white acrylic lacquer that contains a special barrier for ultra violet radiation. This or an equivalent UV barrier is required to protect the epoxy and foams from deterioration (see Section V). 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 VariEze 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 thepaint 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 tranparent when sanded. If there is glass structure damage, repair as shown in Section I, chapter 3. Delaminations are rare, due to the proper design of joints (none have occurred on N4EZ or N7EZ). If a delamination occurs (skin trailing edge joints, etc.), spread the joint, sand the surfaces dull, trowel in wet flox (RAEF), clamp back together and let cure, or use the method in Newsletter 13, page 5.

Plexiglass Canopy

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

Engine, Prop, Accessories, Wheels, Brakes, Battery

Follow manufacturer's recommendations for maintenance/inspection.

The Rosehan brakes must be adjusted frequently. Tighten the nut until the wheel will not turn, then back off only 1/4 turn.

Prop bolts - recheck torque (180 inch/lb) after initial run, after initial 10 hours and each 50 hours.

Dissamble and check carb float bowl for contamination each 25 hour up to 100 hours and every 100 hours thereafter

Each 25 Hours

Inspect electrical wiring for chafing or loosening.

Inspect landing gear, canopy, engine mount, exhaust system and control system for cracks, corrosion and security.

Check brake fluid level and inspect brake puck wear.

Check tire wear and inflation.

Check air and fuel filters.

Annually or Each 100 Hours

Review all items in the initial systems checkout (page 28), except weight and balance. Redo weight and balance after any modification or addition of components.

Jack or lift the weight off the wheels and measure the spread of the main gear. If it's more than 56 inches at insides of strut at axles, move it inward using the method in newsletter 15.

Canard Installation/Removal

First, assemble the elevator pushrod to the elevator belcrank. Park your airplane nose down. Slip the pushrod into the fuselage and lower the canard into position. Hold the canard slightly leading edge high, engaging the locating pins, and then slip the canard into position. Starting with the leading edge high will help the elevator torque tubes slide into position easily. Next, install the two AN4-12A bolts through the F22 bulkhead into the nutplates on the canard tabs. Add washers under the bolt head if necessary so that the bolt will tighten without bottoming prematurely in the nutplate and so that the bolt shank (not threads) is into the canard attach tab. This may be different on each side, due to the sweep alignment technique used in chapter 14. Use a 7/16" socket with a ¼" drive ratchet to tighten the canard attachment bolts. These bolts should be snugged well (about 30 inch-lbs), but not over tightened. It helps to leave the elevator trailing edge up for easier clearance around the elevator belcranks.

Lastly, install the elevator pushrod quick disconnect pin. If the airplane isn't equiped with the pushrod disconnects, then install the bolt, washers, and nuts at the belcrank as shown in chapter 19 of the manufacturing manual.

If you remove your canard for access up forward while the wings are on, add some weight (30 lb) in the front cockpit to keep the nose down securely.

Wing Installation/Removal

You can install and remove the wings alone, however, until you get familiar with the procedure, get one person to help you. Get your tools, taper pins, and bolts together before you start. You need a 7/16" socket with a 1/4" drive ratchet, a small hammer, a clean rag, some lubricant and wooden dowel 12 inches long and about 3/4" in diameter (used for wing removal only).

Clean and lube your wing fitting and taper pins. Have your assistant support the wing tip while you handle the root. Give your assistant directions to align the wing fitting fore and aft, get the tongues just started, have your assistant raise or lower the wing tip to get the fitting aligned vertically, then slide the wing on gently. Drop the WA4 taper pins (not threaded) into the top, then slip WA4-1 (threaded) taper pin into the bottom and then install the AN4-5 through bolts. The through bolts are just snugged, not pulled up tight. Have your helper jiggle the wing a little to make sure the taper pins are seated. Install AN364-416A jamb nuts on the protruding ends of the through bolts.

Connect the electricals, rudder cables and aileron pushrods.

When you have practiced with an assistant a few times, then you can try it alone. You support the wing about three to four feet from the root or use a box or a saw horse at the tip. Once you have the top taper pins pushed into position, you can let go to use both hands for the remaining tasks.

To remove the wing, you reverse this sequence. The wooden dowel and hammer are used to pop the taper pins loose. Remove the jamb nuts, back the through bolts out about three turns, tap the head of the bolt to loosen the lower taper pins, and catch them as they pop loose. Run the dowel up through the lower taper pin hole, pull out the bolt, and then tap the upper pins out by striking the dowel with a hammer.

Supporting the wing tip with a box or saw horse will make taper pin removal easier. Be sure to support the wing as you remove the last taper pin.

Remove the taper pins, grab the wing about three to four feet outboard of the root and slip it off. Store your wings in a rack where they are protected from dings and scratches. You can easliy fabricate a nice wing rack from your foam scraps that will fit like a glove and not scratch the paint.

APPENDIX IV
FAA RECORDS

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

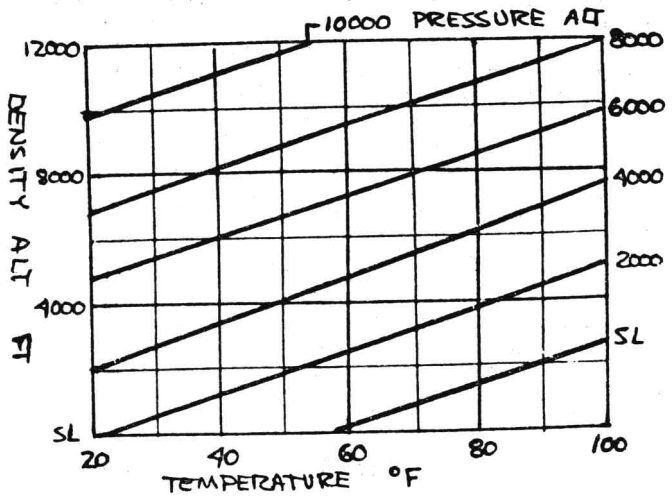
FILL IN THE FOLLOWING TO COMPLETE THE DESIGN DOCUMENTATION OF YOUR AIRCRAFT:

1. This aircraft was built to the drawings described in VariEze manufacturing manual.
   _____Yes _____No.
2. Rutan Aircraft Factory has assigned serial number _____.
3. Modifications are completely documented as shown (if you have modified the design, you should make a drawing to show the change):

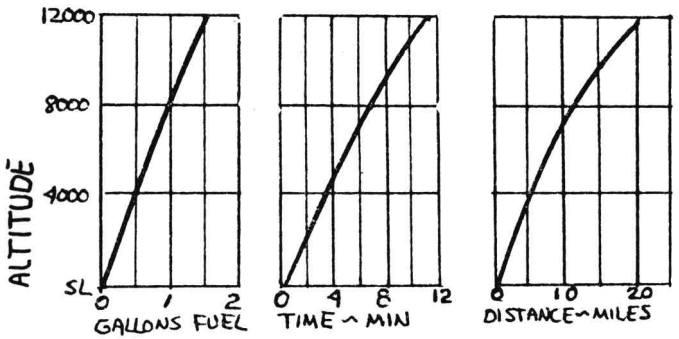
Modification	Drawing No.
_____	_____
_____	_____
_____	_____
_____	_____

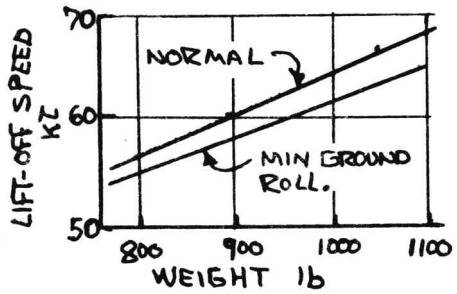
APPENDIX V
PERFORMANCE DATA

To determine density altitude.

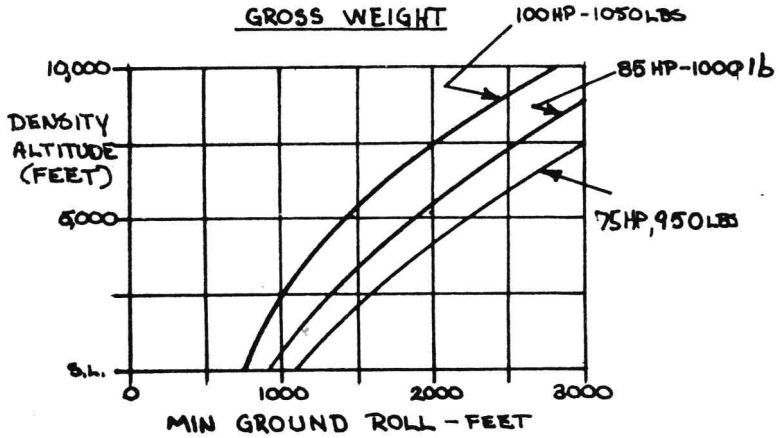


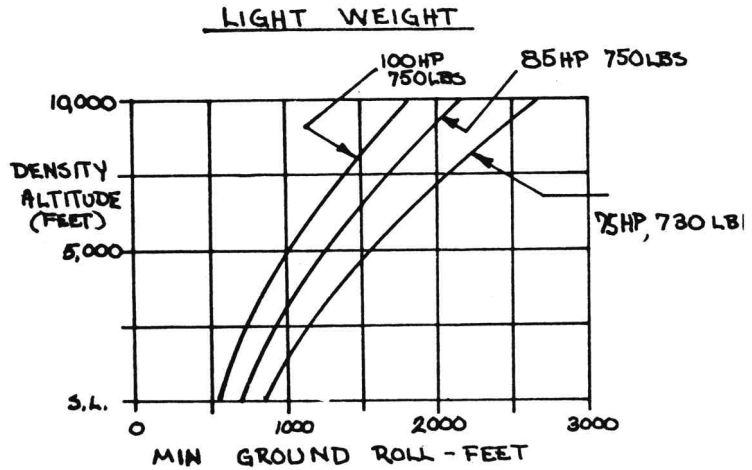
FUEL, TIME & DISTANCE TO CLIMB @ 100 MPH





TAKEOFF DATA FOR TEDS PROP

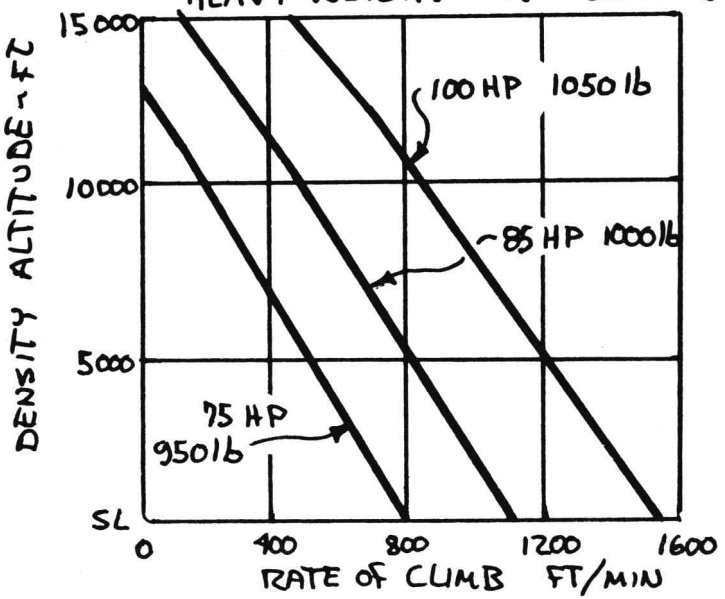




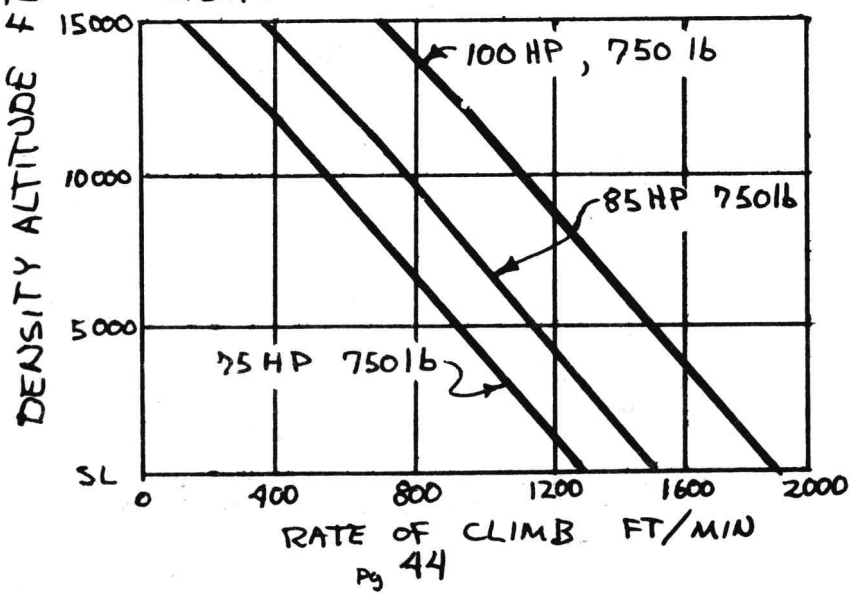
NOTE: DUE TO BRAKING REQUIREMENTS, CROSSWINDS CAN EXTEND TAKEOFF ROLL.

CLIMB DATA FOR TEDS PROP

HEAVY WEIGHT V_i = 80 KT (92 MPH).

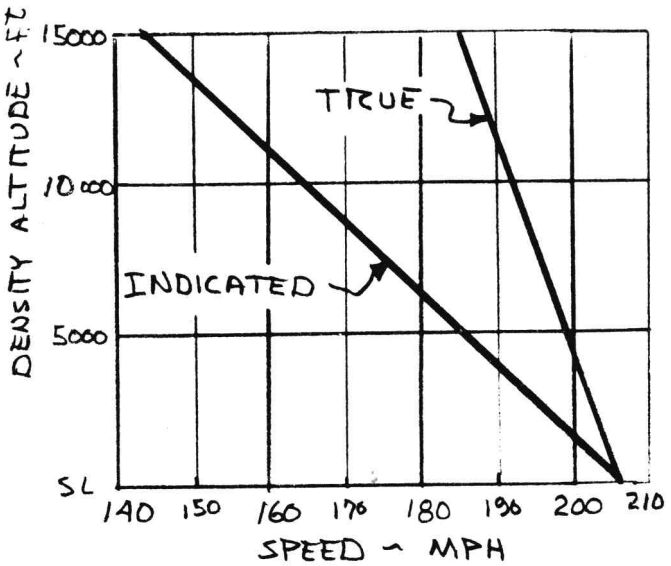


LIGHT WEIGHT V_i = 75 KT (86 MPH)

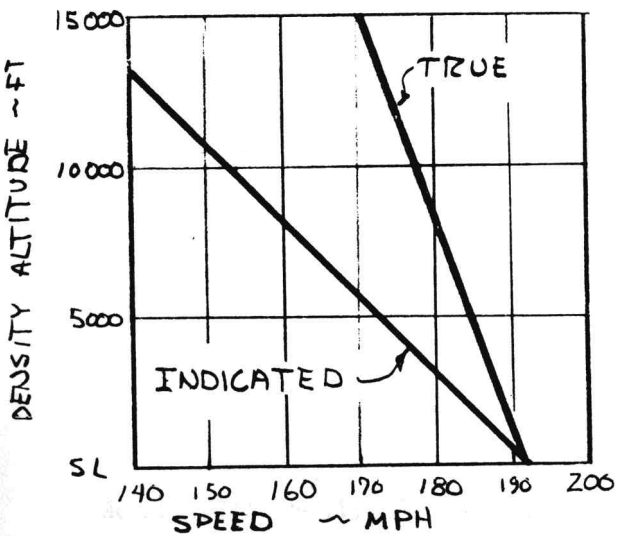


CRUISE DATA FOR WHEEL PANTS NO PANTS - SUBTRACT 6 MPH

100 RATED HP ENGINE
FULL THROTTLE SPEEDS

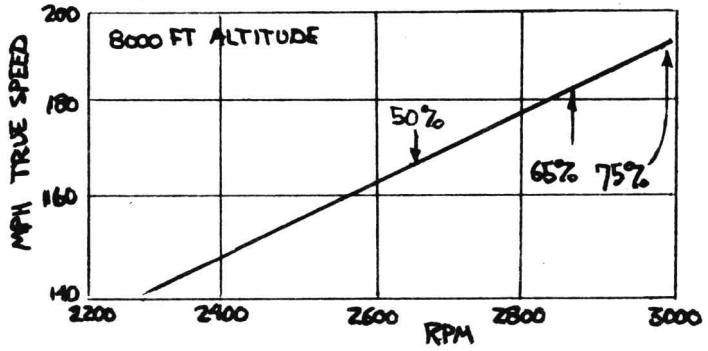


85 RATED HP ENGINE
FULL THROTTLE SPEEDS

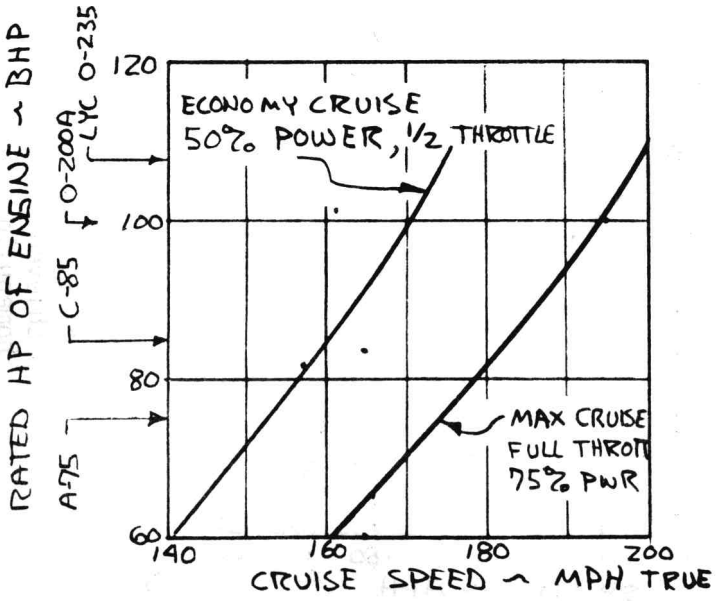


Note: Cruise data based on performance achieved with N4EZ and verified by other homebuilders. However, many VariEzes are 10 to 20 mph slower than data shown.

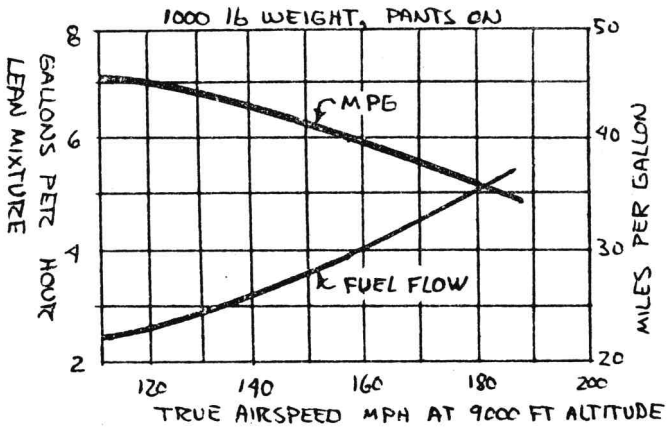
RPM for cruise with O-200 Engine.
Note: VariEzes cruise at higher rpm than normal light planes because of the larger speed range required.

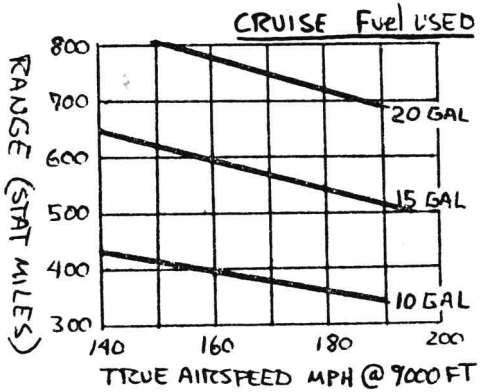


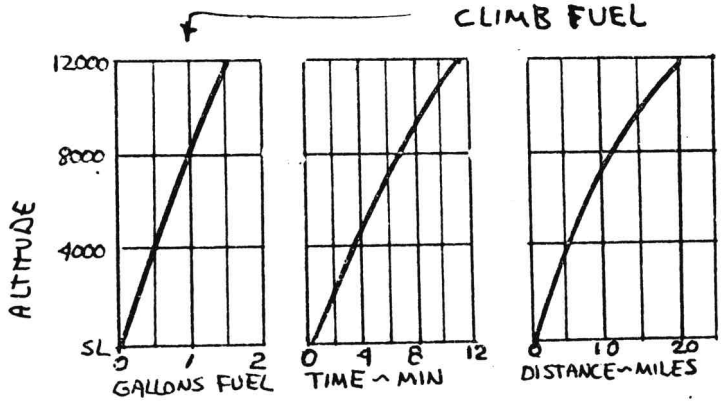
CRUISE SPEED AT 8000 FT ALTITUDE FOR ALL ENGINES



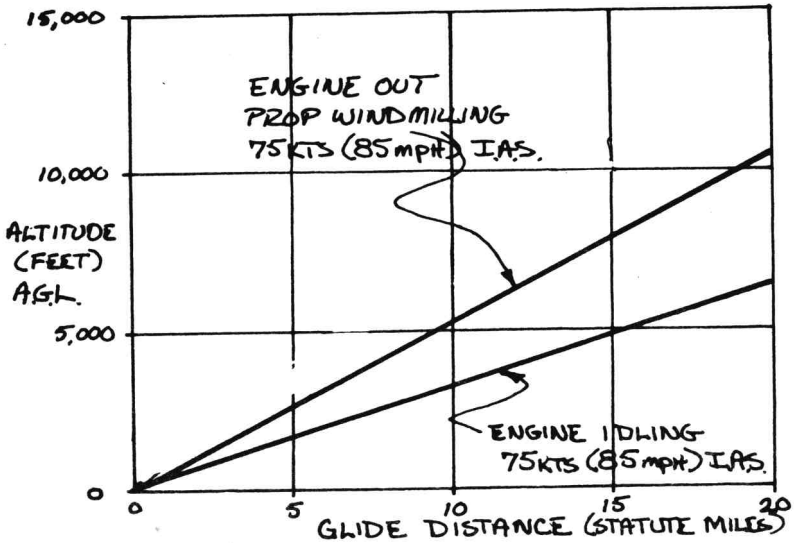
FUEL FLOW





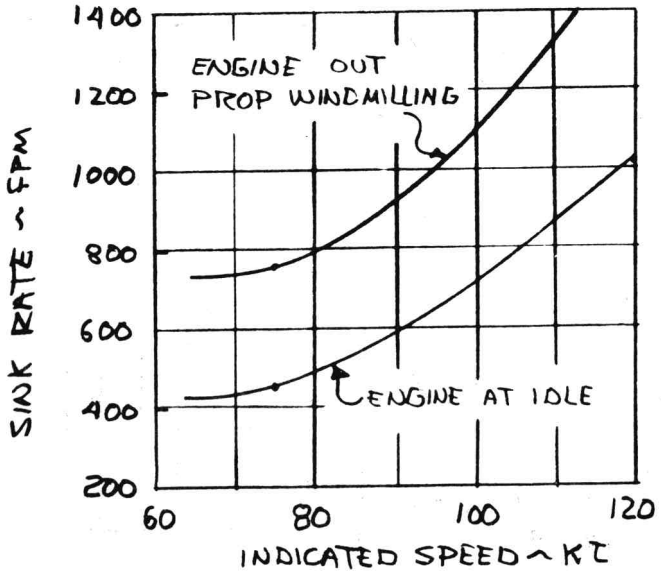


GLIDE - GEAR UP

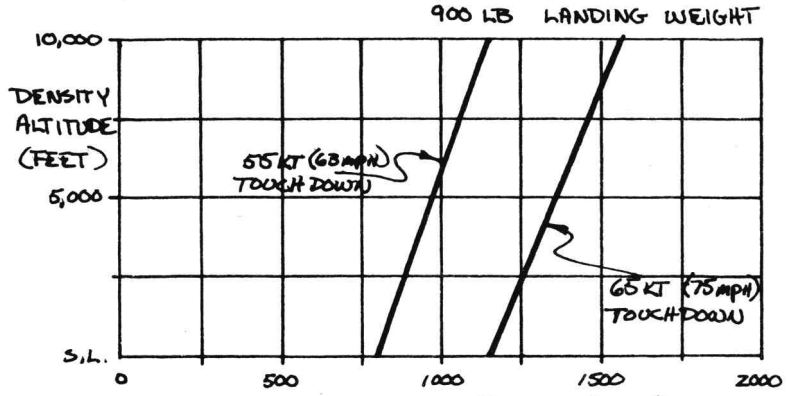


SINK RATE - SEA LEVEL

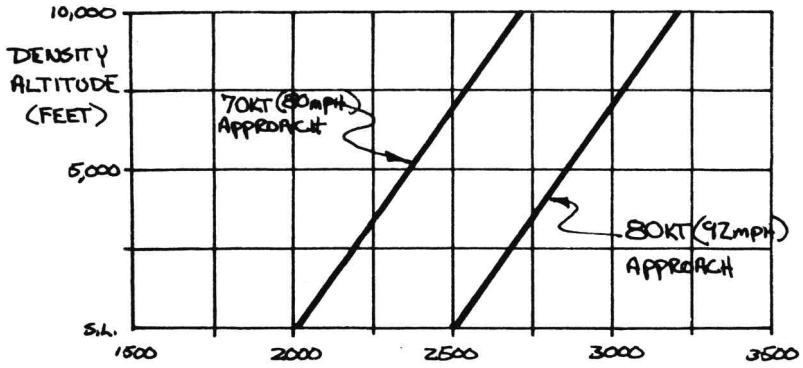
GROSS WEIGHT 950 lb
GEAR UP.



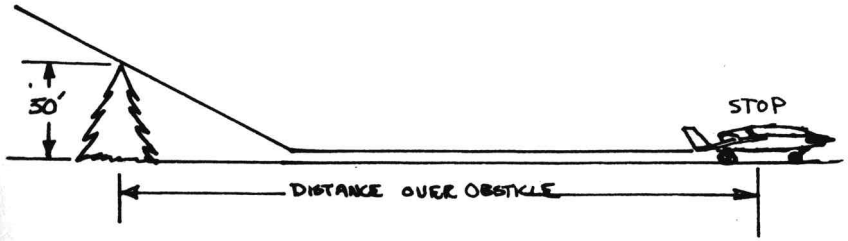
LANDING



SUBTRACT 100 FT IF LANDING BRAKE IS USED.

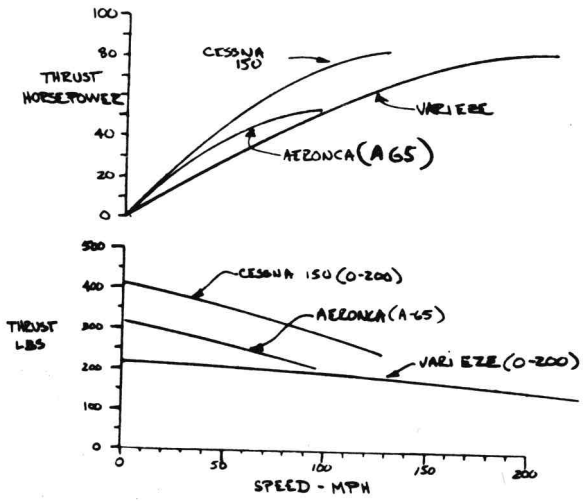


SUBTRACT 400 FT IF LANDING BRAKE IS USED.



Pusher Engines: As you engine experts know, the Continental O-200 (100hp), C85 and C90 engines have a special crankshaft for an FAA-approved pusher installation. These special cranks are rare and expensive. We don't believe that these special parts are necessary for the VariEze. The difference between the "pusher" O-200 B and the tractor O-200 A is a reinforced flange to take the high static thrust loads that you find in amphibian type or other slow aircraft.

The O-200, C85, C90, C75, A80, A75 and A65 crankshafts are almost identical (not interchangeable) and the A65 engine is approved as a pusher without modification. Because of the fixed-pitch prop, designed for 200 mph cruise, the thrust loads on the 100-hp O-200 A are lower than they are on the 65 hp A65 in a "normal" installation.



Pusher Installation of Continental Engines.

N4EZ now has 480-hours flying time with the O-200 A continental engine. No measuarable end-play wear has occurred. Absolutley no problems have been encountered with the unmodified O-200 A engine.

REGISTRATION NUMBER N_____

BUILT BY_____

ADDRESS_____

_____

DATE OF MANUFACTURE_____

DATE OF FIRST FLIGHT_____

SOLD TO_____

ADDRESS_____

_____

DATE SOLD_____

NOTES_____

—NOTES—

VARIEZE CHECK LIST

Exterior Inspection

COCKPIT
- Master off/mags off
- Canopy hinges and latches secure

CANARD
- Undamaged, hinges and balance weights secure

FUEL
- Visually check quantity
- Check cap o-ring and security
- Vent line unobstructed

ENGINE/PROP
- General conition/oil level/baffles secure
- Carb inlet/cooling inlet clear
- Drain gascolator and wing tanks
- Spinner and prop bolts secure
- Prop for nicks/erosion
- Exhaust tubes for security

MAIN GEAR
- Tire wear and inflation
- Brake for wear and security
- Gear strut secure

NOSE GEAR
- Strut/pivot secure and undamaged
- Friction damper - must require 2 - 4 lb force to swivel
- Tire wear/inflation

WINGS
- Tiedown hardware removed
- Structure undamaged
- Roll trim hinges and pushrod secure
- Rudder hinges and cable secure
- Aileron hinges secure
- Rudder spring secure and rudder returns to neutral

Atch. taper pins, bolts, jam nuts secure

FUSELAGE
- Cowling camlocks secure
- Exhaust tubes secure
- Structure undamaged
- Pitot and static ports unobscured
- Canard bolts secure
- Landing brake secure

CONTROL SYSTEM
- Stick free and secure
- Pushrods and bolts secure
- Rudder cables/quick disconnects secure

ENGINE START
- Parked on nose bumper
- Mixture rich/carb heat cold
- Throttle pump and crack
- Master and mags on/pull prop through
- Gear locked down before pilot entry

BEFORE TAKE OFF
- Correct pilot position
- Controls free
- Yaw and roll trim - takeoff position
- Pitch trim - light aft force
- Instruments check/set altimeter
- Fuel quantity/valve on
- Fuel caps on
- Magneto check/carb heat check
- Mixture rich (except high altitude)
- Landing brake up
- Canopy locked - check safety catch for proper engagement.
- Fuel valve - wings

TAKE OFF
- Rotate 45-50 kt (55 mph)
- Lift off 60 kt (70 mph) light weight
- Lift off 65kt (75 mph) heavy weight
- Climb 80 - 90 kt (90-105 mph)
- Gear up

CLIMB
- Trim as required
- Lean above 5000 ft
- Throttle - full

CRUISE
- Throttle as desired 40 to 75% power
- Mixture lean as required/trim hands off
- Fuel - check for balanced fuel level
- Carb heat - on in moist air if low power

DESCENT
- Mixture - rich below 5000 ft
- Trim as required
- Select fuselage tank if wings are less than 2 gallons each

LANDING
- Carb heat - on
- Gear down below 115 kt (135 mph)
- Landing brake down below 85 kt (100 mph)
- Pattern 80-85 kt (90-100 mph)
- Final approach 75 kt (85 mph)

SHUT DOWN
- Radio and electricals off
- Mixture lean/master off/mags off
- Park nose down/tie down