PILOT OWNERS MANUAL

Wide-body LongEZ N3R

May 2002

Wide-Body LongEZ
N3R
Pilots Owners Manual

REGISTRATION	N3R
BUILT BY	Timothy L. Crawford
ADDRESS	447 Spring Wood Lane Idaho Falls, Idaho
DATE OF MANUFACTURE	July 2, 1986
ENGINE	Lycoming O-320 E2D
ENGINE SERIAL NUMBER	L-33648-27A

SOLD TO ____________________

ADDRESS ____________________

____

DATE SOLD ____________________

NOTES ____________________

____

____

____

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

CONTENTS

DISCLAIMER

Wide-Body LongEZ N3R incorporates ***many*** significant changes and enhancements over Rutan's original 1980's Long-EZ design. The utility of the enhancements became apparent after building a standard Long-EZ and flying it for 400 hours. This Pilot's Owners Manual was written ***specifically*** for N3R with the intent to better inform pilots of N3R's changes and thereby enhance operational safety.

The authors have been careful to provide an accurate and improved owners manual for the specific changes incorporated in N3R. At this writing, we have safely flown N3R more than 3,600 incident-free hours. This manual incorporates the wisdom of the original Long-EZ owners manual and our experience. However, we caution that errors are likely. As usual – *The pilot is the final authority on any flight safety issue*. Anyone using this manual does so at his own risk without recourse against the authors. To encourage safety, any material may be reprinted.

GENERAL DESCRIPTION

Early in the early 1980's, a revolutionary high-performance sport aircraft design called the Long-EZ was introduced by Burt Rutan. The Long-EZ is a custom built, long range aircraft featuring the latest advances in aerodynamics and structure to provide good utility, economy, and comfort. Since its introduction, it has become known as a safe and reliable aircraft with *exceptional* performance. It is built entirely from a modern fiber composite structure. Its unique shape results from careful aerodynamic optimization. The forward canard is designed to prevent the aircraft from stalling and spinning. The combination of vertical winglets, low-drag laminar flow wings, and a pusher engine all contribute to its high aerodynamic efficiency. The use of one-way rudders makes use of the winglet camber to tailor 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. Although canard aircraft are easy to fly, there are important differences the pilot must know about.

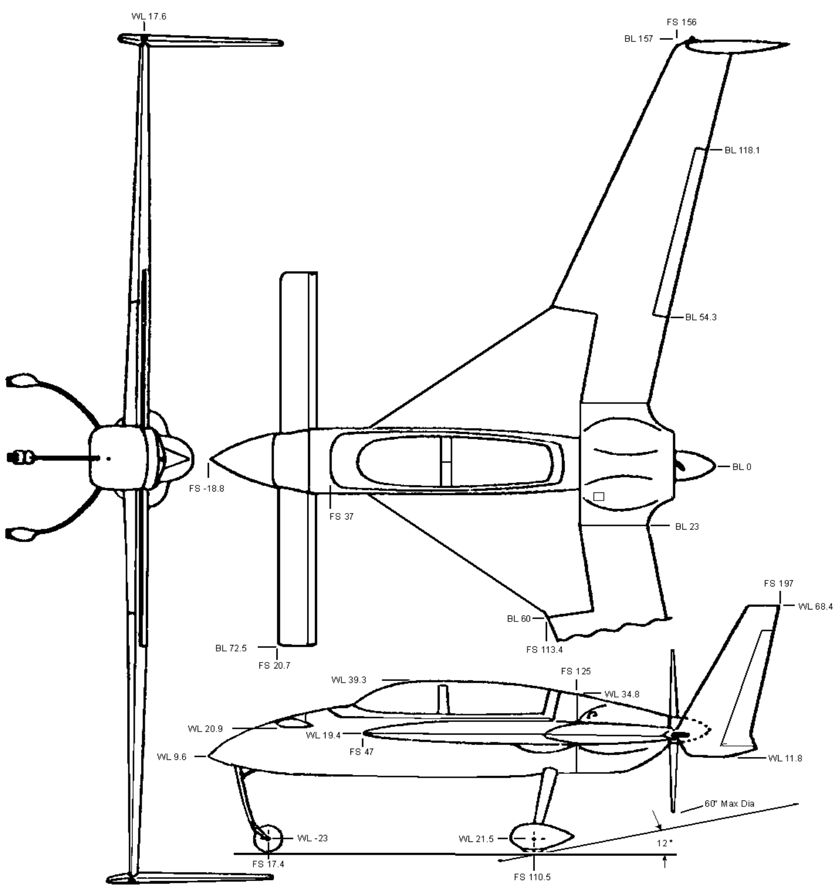
N3R's cockpit layout is designed to compliment pilot workload, with throttle, mixture, carburetor heat, pitch trim, and airbrake controls on the right console and side-stick controller on the left console. A left side-control stick (it's on the right in a standard Long-EZ), allows right-handed pilots to better accomplish "right handed" tasks. N3R's extra wide seats provide improved armrest, lumbar, thigh, and headrest support allowing "recliner-chair" comfort not found in conventional aircraft seats. This allows long, fatigue-free flights. The inboard portions of the large wing strakes are used as baggage areas, accessible from the front and rear cockpit. Total storage is 10 cubic feet.

N3R incorporates *many* enhancements over the original design. During construction, its airframe was strengthened to +9, -6 G's and it was certified for aerobatics. The fatigue-resistant, high-strength structure allows safe operation in extreme turbulence. The cabin is 20% larger than a standard LongEZ. N3R is powered by the more powerful and highly reliable Lycoming O-320 160 HP engine. Its empty weight is 1040 pounds, while its maximum gross take off weight is 1800 pounds. N3R was built with hard points, windows, and external pods to accommodate a wide array of scientific research instrumentation.

Some of the many modifications and improvements include:

- 12" Nose extension
- Nose hydraulic brake sys
- Redundant Electrical
- Nose oil cooler/cabin heat
- Extensive IFR instrumentation
- All electric gyros

- Strake windows
- Ballistic Parachute
- High performance rudders
- Low-drag NACA inlet
- Roncz performance canard
- Hunt style air-filter box
- High-energy metallic brakes
- 8" prop extension w fairing
- No fuel lines in the cabin
- Hooker 40G seat harness
- Four Cyl. electric primer sys
- Stainless brake lines
- 160 hp Lycoming engine
- Large Strakes (73 gal fuel)
- Electronic & visual fuel indication
- Electric airbrake
- Internal rudder belhorns
- Davenport shimmy damper
- Special Hunt four-pipe exhaust
- Four Cylinder CHT/EGT
- Polyurethane (Imron) paint
- Twin ElectroAir Ignition
- Rear seat cntls & inst
- High-energy crash foam seats
- Custom smoke canopy
- Carbon wrapped main gear
- Three blade propellor with 7" hub
- Bucket-seats with impact foam



The following table gives N3R's dimensions with comparison to a standard Long-EZ.

DIMENSIONS		
	Standard Long-EZ	Wide-Body LongEZ
Wing Span/Area	26.8 ft / 81.99ft^2	27 ft / 82.17ft^2
Canard Span/Area	11.8 ft / 12.8 ft^2	12 ft / 13.05 ft^2
Total Wing Area	94.8 ft^2	95.22 ft^2
Length[1]	201.4 in	221 in
Height	94.5 in	97 in
Cockpit Width[2] Front Rear	 23 in 21 in	 27 in 23.5 in
Cockpit Height[3] Front Rear	 36 in 35 in	 38 in 37 in
Cockpit Length Front Rear	 70 in 54 in	 70 in 56 in
Fuel	50 gal	73Gal standard 103 gal w Ferry tank

1. The increase in length derives from a 12" longer streamlined nose section, 2" increase in backseat leg room, and a 8" propellor extension to improve propeller efficiency.

2. The fuselage was widened 3" at the instrument panel, 4" at the pilots shoulders, and 2 in at the firewall. These changes were necessary to install the extensive IFR instrumentation and improve pilot comfort.

3. The fuselage depth was increased 2" to allow the installation of comfortable bucket seats cushioned with space-age impact foam.

> **NOTE:** A standard Long-EZ is not suitable/recommended for operations from unprepared surfaces: gravel, loose dirt, or rough fields. N3R has more horsepower, more propeller clearance and larger tires. This mitigates some of the concern. Regardless, operation from an unprepared surface is still a high risk activity.

WEIGHTS

Originally, N3R's empty weight was 950 lbs. Recent addition of a second electrical system, HSI and other "essential" items (tools, headsets, O2 system, etc.) has increased the empty weight to 1,043 lbs. The maximum normal allowable gross weight for takeoff is 1600 pounds. A gross weight of up to 1800 pounds can be allowed for takeoff -- but only under certain conditions. The strake baggage areas are structurally limited to 100 lb. each side. The airplane can accommodate both large and small pilots or passengers with proper loading. The appropriateness of a loading – pilot, passenger, luggage, instrumentation, fuel – should be confirmed by a weight and balance computation. Nose ballast may be required for very light pilots. See the weight and balance section.

NOAA SCIENTIFIC INSTRUMENTATION

N3R's extensive NOAA environmental research instrumentation is described at http://www.noaa.inel.gov/capabilities/longez. This instrumentation is specifically designed for installation on N3R without structural modifications. With the exception of the turbulence probe, the NOAA scientific instrumentation mounts near the CG and therefore does not impact the CG. When the BAT probe is installed, the propeller crush plate should be changed to the 17 lb. steel ballast plate to correct the CG.

Many of the science instruments mount in the removable strake windows. Various fairings are used to cover the sensor heads. Larger radars, lasers and sensors are mounted in a special belly-mounted instrument pod. The belly pod mounts in place of the airbrake.

> **CAUTION!** The NOAA scientific instrumentation requires extensive electrical interconnection. For EVERY takeoff, the pilot should confirm nothing will interfere with the flight controls. This is essential practice regardless of what is carried onboard.

ENGINE AND PROPELLER

The original Rutan-designed Long-EZ was intended to be powered by a 100-horsepower aircraft engine. To enhance performance, many Long-EZ's are now powered by larger engines. The increased weight of such retrofits adversely impacts the design CG and requires the addition of nose ballast. During construction, N3R was specifically modified for the heaver and more powerful Lycoming O-320 engine. The modifications included not only a stronger dynafocal engine mount and supporting structure but also the stretching of the fuselage to compensate for the additional engine weight. Specifically, the addition of 2 inches more backseat leg room compensates for the heaver engine by moving the weight of the pilot and instrumentation forward. N3R does not require nose ballast.

Only lightweight fixed-pitch solid wooden 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. To better deliver the torque of larger 160HP engine, the propeller drive flange was increased to 7 inches and ½ inch propeller drive bolts are used.

N3R's
Lycoming O-320
Engine Specifications

FAA Type Certificate	274
Rated horsepower	160
Rated speed, RPM	2700
Bore, inches	5.125
Stroke, inches	3.875
Compression ratio[1]	8.5:1
Firing order	1-3-2-4
Spark occurs, degrees BTC[2]	25
Valve rocker clearance (hyd tappets collapsed)	.028-.080
Propeller drive ratio	1:1
Propeller rotation (viewed from rear of aircraft)	CCW

Notes: 1. Originally a O-320-E2D modified with 75089 pistons.
2. Twin ElectroAir electronic ignition systems controls spark timing depending on RPM and manifold pressure.

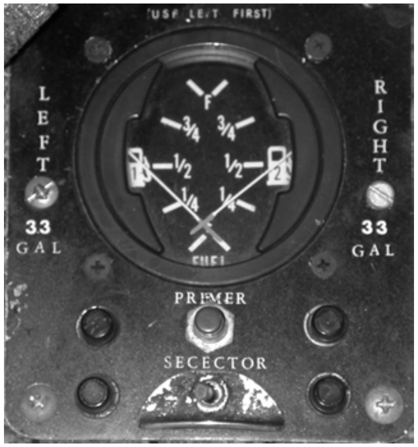
N3R's 3-blade wood propeller uses a plastic (polyurethane) leading-edge to minimize rain erosion and has efficiency close to the best metal prop, while offering a solution to the fatigue problem. N3R performs well with a two-blade (66x70) or a three-blade (62x72) propeller. A three-blade is preferable because it is quieter and its smaller diameter is less likely to pick-up objects which can cause blade damage.

CAUTION! One reason pusher aircraft are more efficient is that they do not blow the high-velocity propeller thrust over the draggy fuselage. The disadvantage is that *anything* that comes off the aircraft is ingested by and does damage to the propeller. Exercise caution that objects are not left on the aircraft, cowling screws are tight, and engine hardware is secure. A new propeller costs more than $1,600!

Recheck prop bolt torque every 25 hours and before next flight when a transition is made from a wet climate (high humidity) to dry conditions. Wood shrinkage in dry environment can loosen prop bolts and result in-flight loss of the entire propeller. N3R has ½" bolts and 7 inch hub that should be torqued to 40 ±5 ft lb.

FUEL SYSTEM

N3R's fuel system consists of two 36-gallon individually selectable wing strake tanks plus an optional back seat 30-gallon ferry tank. Without the ferry tank, there are no fuel lines or selector valves in the cabin area. A tank selector switch, located on the right console just aft of the master switch, selects either left or right fuel tanks. When the auxiliary fuel tank is installed, it pumps to the right strake with an electric fuel pump. Fuel cannot be used from both tanks simultaneously. Two fuel sump blisters, located under each fuel tank at the fuselage junction, assure fuel supply to the engine in all normal flight attitudes. The fuel tank vent is on top and in the center of the fuselage just aft of the canopy. To insure the fuel tank vent can not be blocked by ice, a redundant vent is located in the engine air cooling inlet. A mechanical engine-driven fuel pump transfers fuel from the tanks to the carburetor. An auxiliary electric fuel pump provides backup for the engine-driven pump. The electric pump should be turned on if the engine-driven pump fails. The electric fuel pump should also be used to provide fuel pressure redundancy during low altitude operation, such as takeoff and landing. The mechanical fuel shutoff handle is located below the pilot's right knee just forward of the instrument panel. The fuel cutoff should only be used for emergencies or fuel system maintenance.



Fuel management consol

The fuel selector system on N3R is an electric valve that selects either the left or right fuel tank. When the left tank is selected, the valve requires current to maintain left tank selection. During normal operations, fuel in the left strake should be used first. A prudent procedure would be to always maintain the left stake 10 gallons below the right. Keep in mind that if a serious electrical failure should occur, whatever fuel remains in the left tank will no longer be accessible and a landing must be accomplished before the right fuel tank is exhausted. However, since N3R has redundant electrical systems, total electrical system failure is unlikely.

CAUTION! N3R's engine has a 8.5:1 compression ratio and requires 91/96 minimum octane. Use of 100LL (blue) fuel will prevent detonation and fuel system compatibility problems.

N3R has been test flown without fuel caps with no adverse effects. Should a fuel cap not be replaced or properly secured, it does not create an emergency. Also, N3R's fuel caps have been moved outboard of the propeller arc to insure they will not damage the propeller if lost in flight. To insure they are properly installed, during pre-takeoff check, the pilot should confirm the slot in the cap screw aligns with his line of sight when seated. If not, they are NOT properly locked. Flight test also demonstrated controbality with one tank empty and the other full.

CAUTION! Fuel use MUST be managed! If a tank is run dry, the engine will quit. If low on fuel, use ALL the fuel in the left tank first. With no fuel visible, there is 15 minutes remaining in the sump. Indicated fuel flow will slowly fall to zero 30 seconds before fuel starvation from either tank. Should the engine lose power, *immediately* switch tanks and turn on the boost pump

There are three fuel drains on the airplane, one in the leading edge of each fuel tank strake and one on the gascolator mounted on the firewall. The gascolator is easily accessible through the NACA air scoop on the underside of the aircraft. It can be easily accessed and drained during pre-flight. To prevent overfilling the fuel tanks, exceeding the gross weight limitations for two-place operation, the tanks cannot be completely filled with the nose down. To fill the tanks to the full 73-gallon capacity, the nose wheel must be extended to level the aircraft. **Be careful to hold the nose down during this operation!** Filling to the full capacity should be done only when required for single-place extended range (10 hours!) trips. Before fueling, be clear how much fuel you want. If you do not, you will get far more than you need ☹.

> **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 aromatic content no-lead type, should not be used. They can dissolve the epoxy in the fuel tanks.

CONTROL SYSTEM

Pitch is controlled by a full-span canard slotted flap, which provides a large allowable CG range. Conventional ailerons on the rear wing control roll. The cockpit controls are similar to most aircraft with pitch and roll controlled by the side stick and two rudder pedals for yaw. The left-hand side stick controller is employed to give the pilot the smallest workload control arrangement possible. The large rudders, located on the winglets at the wing tips, operate outboard only, providing two totally independent systems. The rudders are the most powerful control surface on N3R. The rudders are used aggressively during landing, singly for yaw control or deployed together as a speed brake. In-flight, the winglets are so effective, the rudders are not needed to assist in turns.

BRAKES

Powerful brakes are provided on the main wheels. N3R's brakes have been upgraded to Cleveland's high-energy metallic brake 199-197 model. They have 250% more stopping capacity than the original design. The brakes are used together for deceleration on the ground and individually for directional control at taxi speed. 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 ensuring that full aerodynamic braking control or braking is employed before wheel brakes are applied.

A nylon bumper on the nose (nose down parking) provides the parking brake. Avoid parking downhill or downwind to keep the airplane from rolling while extending or retracting the nose wheel

TRIM SYSTEM

Cockpit adjustable trim is provided for pitch only. Yaw/rudder trim is ground adjustable. The pitch trim system is a spring system. Adjustable aerodynamic trim tabs are not used. The pitch trim handle is located on the right console just aft of the throttle quadrant. The pilot can safely override any trim setting even if it's stuck in an extreme position. The pitch trim can trim to hands off flight from stall to maximum speed. This feature allows the pilot to land the aircraft using the pitch trim, rudders, and throttle only. This is an excellent backup should a failure/disconnect occur in the normal control stick. Full forward trim is ~180 knots and full aft trim is ~100 knots.

AIRBRAKE

The airbrake is a drag device used to allow a steeper approach and to provide more deceleration in the flare. This belly-mounted "speed-brake" is deployed by a toggle switch on the right console, just beside the throttle quadrant. Pull the switch aft to deploy the airbrake. It is normally extended on downwind after gear extension and left down until after landing. Maximum speed with the airbrake down is 95 knots. The drag brake on N3R is electrically actuated. There is no provision for automatic retraction should the airspeed exceed 95 knots. The pilot must be aware of this! The airbrake does not affect trim, stability, stall speed, or stall characteristics. The amber light adjacent to the airbrake switch aids in reminding the pilot that the brake is down if he forgets it on his takeoff checklist. Climbs should be avoided with the airbrake deployed, as cooling is insufficient and climb rates are reduced. The airbrake induces a mild buffet when down. During landing and taxi the airbrake provides some prop protection from rocks being kicked up by the nose wheel. Judicious use of the airbrake during takeoff has proved effective to prevent propeller damage during takeoff from runways with excess debris or rocks. In this case, the airbrake should be left open for taxi and takeoff. The brake retraction should begin when airspeed reaches 40 knots and should be complete just after rotation. Use of the drag-brake for power off descents is recommended to prevent shock-cooling.

LANDING GEAR

The Long-EZ features a tricycle landing gear with fixed mains and a retractable nose wheel. The main landing gear uses' Cleveland wheels and

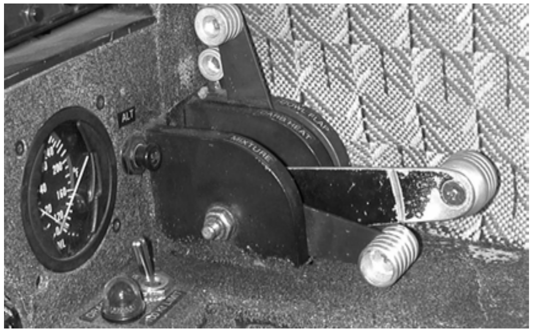
CAUTION! The airbrake blocks engine cooling air. Extended flight – even at low power – with the drag-brake deployed will overheat the engine. This is not a problem for landing or for rapid descents from altitude when no power is being developed. If the drag-brake is deployed much above 100 kts, the fuse to the linear actuator will blow with the drag-brake partially deployed. The indicator lamp, on a separate circuit, will indicate the deployment. To retract the drag-brake, the 7.5A fuse must be replaced.

brakes with 500 x 5 tires. The nose wheel is a 2.80-2.50 4-ply tire and tube. The main landing gear is a one piece, molded S-fiberglass/epoxy unit that gives exceptional energy absorption for bounce-free landing. To minimize drag with fixed main gear, the gear strut is molded into an airfoil shape, eliminating the need for superficial fairing. The main wheels are 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 easy entry for the backseat passenger. Nose gear position is displayed to the pilot through a Plexiglas window, through which he views the nose wheel directly. Ten turns of the nose gear crank will raise or lower the nose gear. The nose gear should only be extended if the flight speed is below 100 knots. The strength of N3R's main gear and mount structure have been enhanced to carry the higher weight. The main gear has been wrapped with additional torsional plies of unidirectional carbon fiber. Then, the gear mounting has also been improved with larger bolts and steel bushings. The brake master cylinders have been moved forward to the rudder peddles and the brake lines have been changed to stainless to enhance robustness and provide a "firm" pedal to the more powerful brakes. N3R is equipped with a light and buzzer gear-warning system that is actuated at low power settings with the gear up. The light alarm is located in the center of the panel along side a buzzer alarm defeat button.

CAUTION! The nose gear extension/retraction is driven by a worm driven gear. If abused, the gear will be damaged. Abuse consists of operation above 100 kts or NOT extending it to the over-center stop when cranked down.

COCKPIT

Both front and rear cockpits are exceptionally comfortable because of N3R's wide-body fuselage. Semi-supine (reclined) seating is provided for optimum crew comfort. Pilots and passengers up to 6 feet 6 inches tall and 220 lb. will find the cockpit quite comfortable. Pilot's 6 foot 3 inches or less, find it easy to seat themselves first and then comfortably extend their legs forward from the sitting position. The canard configuration provides a wide CG range that allows for a full-length rear cockpit without the passenger having to straddle the pilot.



Throttle, carburetor heat, and mixture controls

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

A control stick and throttle is located in the rear to allow the back seater to help with piloting and land if the pilot becomes incapacitated. Rear instrumentation includes a compass, airspeed and altimeter. The rear stick is removable to allow installation of scientific instruments or increased baggage room. The rear seat does not have rudder pedals.

The inboard portions of the large wing 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 the area beneath the thigh support. Baggage areas in the nose, inside the center-section spar and behind the rear seat provide additional stowage.

Due to the insulated fuselage structure and long Plexiglas canopy, N3R will maintain about 60˚ F inside temperature with an outside temperature of 10˚ F (vent closed, sun shining). Thus, the requirement for cabin heat is far less than conventional light-planes. For colder conditions, the hot exhaust from the nose mounted oil cooler can be dumped to the cabin. By closing the cowl-flap, the oil cooler will provides excellent heat in cold weather and up to 16,000 ft. Due to the small cabin volume and good vent location, N3R is more comfortable on hot days than conventional light planes.

The airplane is equipped with an electrical alarm light and buzzer that 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. The alarm also activates if the gear is not down and the throttle retarded with the canopy locked. The master alarm defeat switch is located to the left of the master alarm warning light near the top center of the instrument panel. Use caution to not defeat the alarm by habit or automatic reaction without first understanding the reason for the alarm. Micro-switches on the canopy, nose gear and throttle must function properly for the warning system to work corectly.

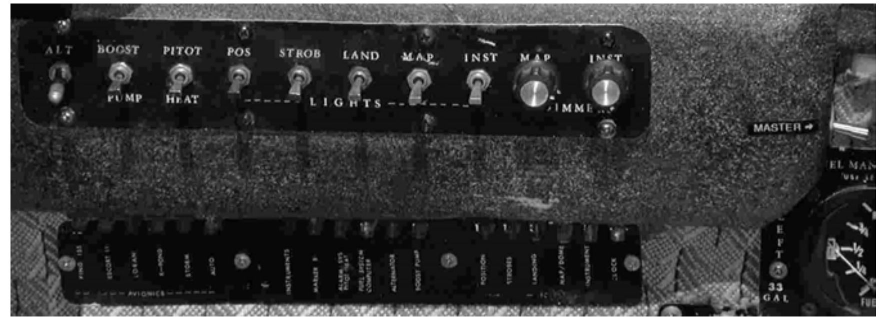
ELECTRICAL SYSTEMS

The master alarm defeat switch is to the left of the alarm warning lights at the top center of the instrument panel. Do not defeat the alarm by habit or automatic reaction without first understanding the reason for the alarm.

N3R is equipped with dual electronic ignition systems, with switches located on either side of the landing gear crank in the center of the instrument panel. Be aware that these act much like traditional magnetos, but the power system for each must be understood thoroughly in the event of a system malfunction.

CHT/EGT, ignition switches and gear crank.

The schematic diagram illustrates N3R's 14V electrical power distribution. N3R has two batteries and two alternators. These four power sources provide significant redundancy to maintain electrical power. The primary electrical source consist of a 25 AH battery and a B&C 60A alternator with LR-3B linear regulator. The secondary electrical system consist of a B&C model SD 8A alternator with a 7AH battery. Power from both alternator system pass through aggressive noise filters to insure a noise-free electrical system. The electrical system allows isolation or coupling of the systems or individual power sources.

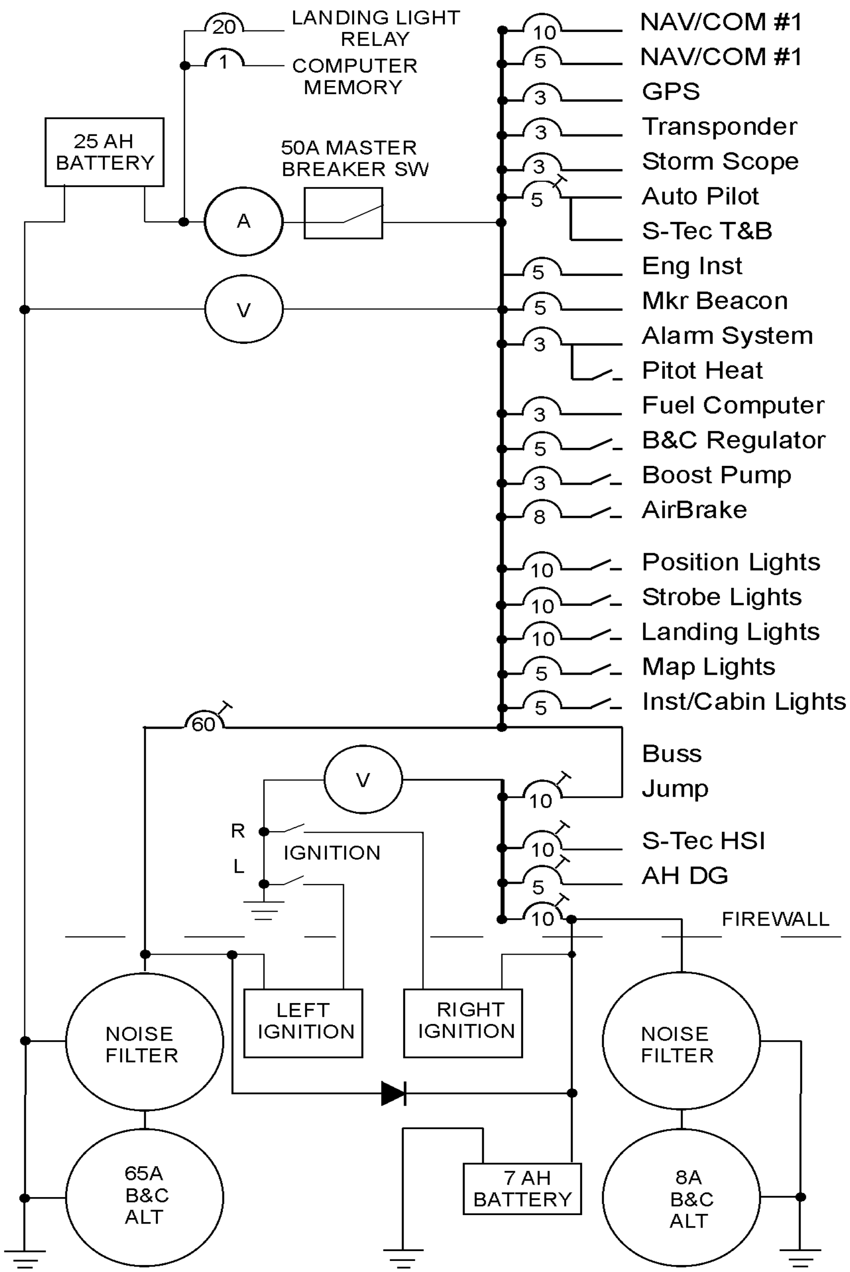


Main buss power distribution console and master switch.

Secondary buss distribution, stereo intercom, and HSI slaving panel

During pre-flight and start, function of batteries and alternators should be checked. In flight, failure of the primary system (indicated by a flashing alarm light) should be considered an emergency. Power should be shed to insure adequate buss voltage is maintained. Failure of the secondary alternator is unlikely as it is a direct drive system (no belt) without brushes. However, the secondary alternator is only 8 amps and will not maintain a full electrical load. Further, the rated 8A output will be available only at rated engine RPM.

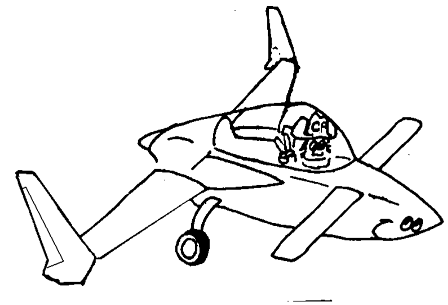
Since the starter is on the 25A battery, one useful start procedure is to power the buss with only the secondary battery during start (i.e., master off buss jump on). This allows instrumentation to be setup during pre-start and left on during start. Following start, the main system is brought on line and the buss jump discontinued. This procedure allows radios and navigation to be setup without inducing a start power interruption.



Schematic diagram illustrating N3R's 14V electrical power distribution

NORMAL OPERATIONS

This section covers the normal operating procedures for Wide-Body LongEZ N3R. A summary checklist is provided in Appendix II for convenient cockpit use. Detailed loading information and performance data are provided in later sections of this manual.



PILOT POSITION

N3R can accommodate tall pilots up to 6 ft 8 in. Short pilots can fly the aircraft but they *must* sit on cushions to position their eyes in about the *same position* as tall pilots in order to have adequate forward visibility. Short pilots should use cushions primarily *under* them, not *behind* them. If a short pilot uses a large cushion behind him, he will be positioned forward and down because of the windshield slant angle and have inadequate forward visibility during climb and landing flare. Confirm that your head is within 1" of touching the canopy before takeoff. The custom-built bucket seats are lined with impact foam and sized for a 5'10" to 6' tall pilot. Shorter pilots will require cushions. Larger pilots must remove the bucket seat and install appropriate cushions.

STARTING

Have your passenger board and strap in while the aircraft is parked nose down. Long-legged types may step directly into the rear cockpit. Shorter passengers can step into the front seat first, then into the rear cockpit. With your passenger aboard, raise the nose by lifting at the canard leading edge. Crank the nose gear into the extended and locked position and enter the cockpit using the step. N3R is 2.5 inches taller than a standard Long-EZ and therefor a bit more difficult to enter. With the left foot on the step and both hands on the side, it is easy to boost oneself to a sitting position on the strake. From the strake, it is a short slide to the front seat. Do *not* try to raise or lower the nose with the nose wheel crank.

N3R has twin electronic ignitions and both a carburetor accelerator pump and 4-cylinder electric priming system to insure easy starting even in very cold conditions. Both electronic ignitions should be on and the two electrical systems should not be jumped (unless one understands the design and function of the two systems). Insure that the prop is clear before starting.

Shout loudly and wait for a response or time for the person to get out of the way. If possible, have an observer confirm the prop is clear prior to engaging the starter. In cold weather, aggressive priming is needed. For a hot-start, leave the mixture at idle-cutoff, crack the throttle and engage the starter. Be ready to go full-rich as the engine will fire immediately.

After starting, the engine should be at fast idle (1,000 RPM) and the oil pressure should rise within 5 seconds. After the oil pressure comes up to within limits, reduce RPM to idle. If it is cold, a fast idle may be required until engine warms a bit and operation stabilizes.

NOTE: Engine start can NOT be accomplished by hand-propping. The dual electronic ignition systems do not fire until the propeller reaches 400 RPM. For security and safety, the start switch is hidden.

TAXIING

Steering below 25 knots is accomplished by applying full rudder and brake as required in the direction that 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, allowing maneuvering in very tight places. At low speed, steering is done exclusively with differential braking. N3R's gear geometry makes it much less sensitive to upset than most aircraft. Safe taxi has been demonstrated in 40 knot crosswind components. Be careful to hold the stick while taxiing downwind so the "tailwind" won't damage the ailerons/elevator. Do not "ride" the brakes and compensate with increased power. Once moving, idle thrust is sufficient.

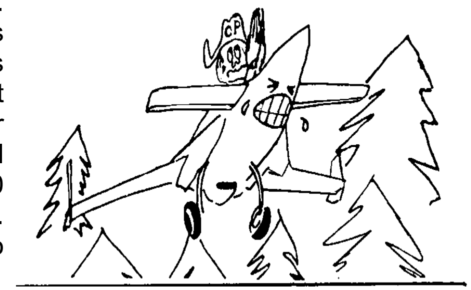
Keep taxi speeds slow and engine power low on unprepared loose surfaces. Pushers are more susceptible to prop damage than a conventional aircraft. Remember to taxi with the airbrake deployed on unprepared surfaces. When taxiing with the canopy open, be careful that the wind doesn't slam it closed on your fingers! *Close and lock the canopy during windy conditions.*

When possible, check the "static" RPM and ignition drop on the roll. Full power operation while not moving develops a vortex under the propeller. This increases the possibility debris will be picked up and damage the propeller.

CAUTION! Excessive use of the brakes will overheat the fiberglass gear legs to the extent the resin becomes soft allowing the gear to fail! Avoid taxi under high engine idle while "riding" the brakes. Also, avoid high-speed landings to short runways. Always use the airbrake and rudder deployment to help slow the aircraft. Doing so will allow the tires and brakes to live longer. ☺

TAKEOFF

Complete the takeoff checklist. Double-check that: the canopy is locked down, the transponder is on, carb-heat is off, the boost pump is on and the trim is set for takeoff. Check static RPM at full throttle. It must be around 2400 for normal takeoff performance. Taxi forward a few feet to straighten the nose gear.



Normal Takeoff -- Apply full power smoothly. As the aircraft accelerates, use rudder and brake as necessary for directional control. Above 40 knots, the rudders alone can control direction. Maintain slight aft stick pressure as you accelerate to relieve the nose wheel. Rotate the nose wheel just clear of the ground as soon as possible about 50 - 60 knots and hold the nose wheel just clear as you accelerate to about 63 knots. As you pass through 63 -65 knots rotate smoothly and you'll be off and flying. Add 5 knots if operating at heavy gross weight.

CAUTION! Never rotate beyond the angle that places the canard on the horizon.

Crosswind Takeoff – During takeoff ground-roll, with a crosswind component above 10 knots, directional braking maybe required long into the ground roll. In strong crosswinds, directional braking may be required right up to rotation speed to maintain 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 50% or more by strong crosswind, especially at high gross weights and high density altitudes. The braking requirement for directional control is the reason for the takeoff limitation of 15 knot crosswinds. Landings can be made up to a 20-knot crosswind component.

Hold aileron into the wind as you rotate for lift off. Let the aircraft accelerate above normal rotation speed and then rotate the nose abruptly to make a clean lift off without side-skip. For crosswind components above 10 knots add 5 knots plus one half the gust factor to the normal rotation speed. When clear of the ground make a coordinated turn into the wind to correct for drift.

SHORT FIELD OBSTACLE CLEARANCE

Reduce gross weight as much as feasible and check the CG to insure it is not so far forward as to delay rotation. Be sure the engine is thoroughly warmed up and taxi to the very end of the runway. Align the aircraft with the runway, hold the brakes and apply full power. Release brakes and try to use minimum braking for directional control. Rotate to lift off at 56 knots (lightweight) or 65 knots (heavyweight). Maintain 70 knots best angle of climb speed, until the obstacle is cleared, then accelerate to 120 knots normal climb speed. See Appendix I for distances.

ROUGH FIELD CAUTION

Even with N3R's larger 500 x 5 tires, it is not well suited for rough, gravel or unprepared fields. Since it is a pusher and a canard, 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 canard can lift the nose. 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 it less suitable for unprepared field operation than a conventional aircraft.

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

appropriateness of deploying the airbrake to protect the propeller just until the nose wheel is off.

HIGH DENSITY ALTITUDE

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

The combination of high aircraft gross weight and high density altitude represent significant dangers for takeoff obstacle clearance. Special care is required to avoid premature rotation, i.e., if liftoff is too slow, the aircraft will be on the back side of the power curve and may not climb.

When operating heavy and high (say, within 100 lbs. of gross weight and above 5,000 ft density altitude) do not fully rotate to liftoff attitude until your airspeed is within 5 knots of the best rate of climb speed, for your specific weight and altitude (see climb charts). This will require more runway than a slower liftoff, but will assure the best capability to clear obstacles and continue a safe climb. Never attempt takeoff under conditions in which you cannot achieve best rate of climb speed while still on the available runway. If this ability is not clear at any point during takeoff - abort. Off-load weight or wait for a cooler time of day.

Lift off is possible as slow as the "minimum lift off speed," and can be successfully used at light weights and/or low altitudes to achieve a short ground roll. However, that technique will usually result in inadequate initial climb if used when heavy or high.

Runway slope effects are minor when light or at low altitudes, but they become very significant when heavy/high. For example, a one percent uphill runway slope may add well over 1000 feet to the distance required to clear an obstacle. Never takeoff uphill when your takeoff roll performance is marginal. Never continue a takeoff if crosswinds require you to brake so much that a safe liftoff is in doubt. Always use "best power mixture" for high attitude takeoff conditions. An over-gross weight takeoff that seems like an acceptable operation near sea level is a high-risk operation when hot and high.

> **CAUTION!** Before every takeoff, note where the runway half-way point is located. During takeoff, if the nose wheel is not off by that point, abort the takeoff and reconsider your situation! It may be your last chance as obtaining only 75% of the needed flight speed in half the runway is marginal. ☹

CLIMB
Climb performance data is given in Appendix I. For an optimum rate of climb, maintain 90 knots. Best angle of climb is obtained at 70 knots. For better visibility and improved cooling, a normal cruise climb of 120 knots is used. Climb performance is improved with the nose gear retracted and it should be retracted once your initial climb is established.

CRUISE
Lycoming's maximum recommended cruise power setting is 75%. A high cruise power setting (full throttle at 8000 ft density altitude) will result in maximum true cruise speed of 175 knots. However, to take the best advantage of range and fuel economy, you may find that cruise power settings as low as 45% get you to your destination faster by avoiding fuel stops. Cruise at 60% power is the best compromise, providing good speeds and significant lowering of the engine noise over 75% power. Lean the fuel mixture for best economy at cruise. Below 75% power, lean the mixture until very slight RPM loss is noted (20 RPM max). This approximates the peak EGT setting for optimum lean mixture. Note that best range is obtained at a very low speed (see Appendix I).

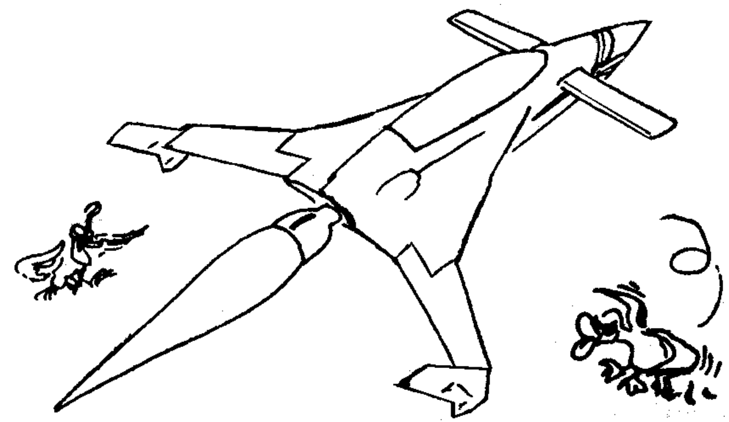
Maneuvering speed is 120 knots indicated - remain below this speed in rough air.

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

Once at a cruise altitude in smooth air, trim the aircraft to allow hands-off cruise. It is much less fatiguing to fly by using fuel distribution and an

occasional shift of the body weight along with an occasional small adjustment of the pitch trim, 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.

N3R's S-tec System 50 auto pilot will maintain direction and altitude. Selectable directional inputs include stability (wing level or turns), DG-Bug, VOR, localizer or GPS. The auto pilot works very well and takes the work out of long cross-country travel or single-pilot IFR. With a good CD-selection and a ANR headset, the PS Engineering 2000 stereo intercom will ensure enjoyment. ☺



> **<u>CAUTION!</u>** On May 5, 1996, Jim Price set the altitude record at 35,027 ft with his LongEZ. N3R goes to 30,000 ft with NOAA instrumentation. Clearly, the altitude capability of the Long-EZ far exceeds the physiological capabilities of the pilot. Use oxygen as appropriate.

The Lycoming engine is not very susceptible to carburetor ice. Icing can occur during cruise in moist air, particularly at low cruise power settings, When in moist conditions, check carburetor heat often or cruise with heat on.

RAIN
Our flying experience includes many hours in light to heavy rain with no problems. Unlike the canopy on standard Long-EZ's, N3R's canopy was shortened and the attach points moved so that it does not leak air or *rain* in-flight regardless of the OAT. Because N3R carries the newer Roncz Canard, very slight pitch trim change occurs when entering rain.

> **CAUTION!** Blasting through rain at high flight speeds and high RPM will erode the paint off the wing leading edges and damage the propeller leading edge. When rain is encountered, slow to 100 knots.

IFR
N3R's operating limits allow IFR operation. IFR operations are only limited by "instruments and equipment" available for the "type of operations engaged." The panel instrumentation is extensive and includes: twin Nav/Com's, twin altimeters, twin air speed, ILS, HSI Storm scope, MB, autopilot, IFR enrout and approach GPS. These instruments combined with N3R's performance and oxygen system allow for serious long-range travel.

DESCENT
N3R's 160 HP engine provides excellent climb performance. Higher cruising altitudes should be used to enhance fuel economy and avoid

turbulence discomfort. It is not unusual nor inefficient to climb to 12000 feet altitude for a 150 mile trip. Bearing this in mind, plan descents into the destination enough in advance so that you don't find yourself over your destination with 10,000 ft of altitude. N3R is a clean airplane and even with power at idle it may take 15 minutes to land! A cruise descent is an efficient way down. Don't forget to reduce power slowly to avoid rapid cooling of the engine. Partially enrich mixture when descending. Start descents about 6 miles from the destination for every 1000 feet of height to lose to arrive at pattern altitude. However, by deploying the gear, drag-brake, and both rudders, and forcing a mild slip, N3R will descend at ~2,000 fpm at 100 knots flight speed.

LANDING
Make your approach and traffic pattern cautiously. Most pilots and controllers are accustomed to looking for more conventional aircraft of gargantuan proportions and may ignore you completely. The best pattern speed is 100 knots, slowing to 80 knots on base and finally slowing to 70 knots on short final (75 - 80 knots in turbulence or gusty winds). N3R is a very clean airplane and you can double the runway length required if you are high or 10 or 15 knots fast on your approach.

Turning base, deploy the airbrake to obtain a normal glide path angle comparable to conventional aircraft. Failure to use the airbrake will result in a flat/wide pattern, more difficult airspeed control and the probability of overshooting your desired touchdown point. Make a complete flare and touch down at 60 knots. *The normal landing technique of holding the nose off to minimum speed should not be used*. Make a complete flare, then fly it down to touch down. This avoids a common tendency to flare too high or to stall the canard just off the runway. While full-stall landings are easily done with some practice, it is safer to "fly the aircraft on" 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 high-pressure 500 x 5 tires will give a harsh ride. This, combined with the 60 knot touchdown speed, makes a hard-surfaced runway much more pleasant. If you need to land on a rough field, hold the aircraft off to minimum speed and keep the nose high as long as possible.

> **CAUTION!** Never flare beyond the angle that places the canard on the horizon. If you stall the canard before the mains are on, the nose will fall to the runway – this is a potentially dangerous situation which may damage the nose gear. FLY IT ON!

Crosswind landings may be flown 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 the rudder immediately before touchdown. Be careful to not lock a wheel brake (full rudders) at touch down. N3R has demonstrated taxi, takeoffs, and landings in gusty Idaho winds to 40 knots and with crosswind components as great as 20 knots for takeoff and 30 knots for landing. Only *experienced* pilots should attempt flight operations in such windy conditions.

Fly from long runways until you develop proficiency. The following runway lengths can be considered as minimums, but only after you have made at least 20 landings on longer runways: with the airbrake, 2500 feet, without airbrake 3500 feet at SSL.

Remember to "clear" the idling engine every 15 seconds or so on the approach. Also, always fly finally with the speed brake and at an altitude to allow reaching the runway without the engine after retracting the speed brake.

CAUTION! If the CG is aft, it is possible to rotate the nose to an excessively high angle during landing rollout, placing the CG aft of the main wheels. Avoid rotation above 12 degrees (canard on horizon), using forward stick or brakes as necessary, to avoid prop damage or tipping the aircraft on its tail. If a high angle of attack develops before the mains touchdown, add power and lower the nose.

LANDING GEAR SPEEDS

Do NOT extend the nose gear above 100 knots. At higher speeds, the air loads make it hard to extend and may damage the gear extension mechanism. The gear can be down or can be retracted up to 140 knots.

GROUND HANDLING AND TIE DOWN

Due to its unusual design, N3R attracts attention. Be watchful of the aircraft and cautious of spectators. Spectators and passengers must be cautioned that the control surfaces are delicate and the fiberglass skin can be “dented” by “leaning” elbows, and knees. Explain to those entering not to impose high compressive loads to the strake surface as it will cause a permanent indentations.

The easiest way to handle the aircraft on the ground is to insert the nose tie down ring and use it as a handle. Alternately, 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 handles best with the nose slightly lower than level.

N3R can be safely left unattended, parked on the nose bumper, in moderate winds. However, it is prudent to always tie down any aircraft whenever possible. For long term parking, position it backward in the parking slot with the nose over the normal tail tie down rope. Install the removable tie down ropes, two near each wing tip and one on the left side of the nose just forward of the canard. Relieve the main gear stress 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. Finally, install the control surface gust locks.

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.

CAUTION! With the nose gear extended and without the pilot in the front cockpit the N3R can fall on its tail. Tipping over is a REAL possibility. From experience, we know it will damage both wheel pants, the propeller, and both winglets ☹. It may initially sit on the nose wheel but may tip backwards when the fuel bleeds throughout the baffles towards 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 the aircraft is subject to being moved by unknowledgeable people, ballast the nose or attach a sign to caution them about the possibility of tipping over.

LOW SPEED HANDLING AND STALL CHARACTERISTICS

The Long-EZ has good flight characteristics at minimum speed. It is a docile, controllable airplane at full aft stick at its minimum airspeed of 55 knots. It doesn’t exhibit any of the conventional airplane’s tendencies to roll or pitch down uncontrollably or other common uncommanded flight path excursions. Any power setting 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

60 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 N3R are so much better at minimum speed than contemporary conventional aircraft, it hardly seems fitting to use the term "stall" in characterizing the behavior, even though it is technically correct. The canard will stall but not the main wing. A "stall" consists of any one of the following, in order of prevalence:

➜ Stabilized flight (climb, level, or descent depending on power setting) at full aft stick. Below 60 knots there is a very definite increase in the aft stick force, such that the pilot has to pull noticeably harder on the stick to get below 60 knots.

➜ 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 "bucks" per second. If the full aft stick is relieved slightly, the bucking stops.

➜ Occasionally, particularly at aft CG, the airplane will exhibit a mild uncommanded Dutch-roll, a rocking back and forth of the wings in roll. It may be divergent, reaching 30 degrees 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 *very slight* pitch trim change; neither effect the aircraft's controllability at sustained full aft stick.

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

> **<u>CAUTION!</u>** Aft of the allowable aft CG limit, main-wing stall may occur and may or may NOT be recoverable. To recover, apply forward stick and full power. Recovery will result in a stall break with high sink rate. In 3,600 hours, N3R has shown no undesirable tendencies near aft-CG and has never main-wing stalled.

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 pull up results in a lazy spiral that ends up in a steep rolling dive at 3+ g and 100 knots. At any time, the spiral can be immediately stopped by removing rudder control and a straightforward recovery can be made. That maneuver is not a spin, since at no time is the aircraft departed from controlled flight. If the above maneuver is done at aft CG, the rotation rate is higher so the lazy spiral is more of a slow snap roll. However, even at aft CG the recovery is immediate when controls are neutralized. N3R is approved for stalls in any power, trim or landing condition within the normal operations envelope. Intentional attempts to spin are not approved.

EMERGENCY PROCEDURES

FIRE

There are 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 in-flight fire, determine the cause: if electrical, all electrical power off; if fuel, fuel off and electrical power off. There is no need to turn the cabin heat off as its source is the nose mounted oil-cooler. Execute a precautionary landing as soon as possible.

ENGINE FAILURE

N3R's Lycoming 320 series aircraft engine is extremely durable and unlikely to 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 (fuel starvation, carburetor ice, confusion of mixture and carburetor heat controls, etc.). In the event of in-flight engine stoppage, switch tanks and turn the boost pump on. Then check mixture - RICH, ignition - BOTH, and attempt restart. A windmill start uses less altitude if you initially dive steeply to rapidly attain 135 knots to get the propeller turning. If the engine begins to run rough, check for induction icing, improper mixture setting, or a bad ignition system. If switching fuel tanks or adding carburetor heat 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. However, as the engine cools down a higher speed maybe required, to maintain engine rotation. A speed as high as 100 knots maybe required to maintain windmilling. Windmilling RPM decays slowly enough to give the pilot time to increase his speed to maintain rotation. Once the prop stops, a speed of 140 knots or more is required to regain rotation (2500 foot altitude loss). The pilot should determine when it is no longer feasible to, attempt restart, since the best glide angle speeds (Appendix I) maybe lower than windmill speeds (best glide distance maybe done with prop stopped).

ELECTRICAL FAILURE
Shed electrical demand to maintain electrical power to the ignition system.

ENGINE OUT APPROACH
If an engine-out landing is unavoidable, check wind direction, choose your landing area and establish your glide at 70 to 75 knots. Gliding performance is shown in Appendix I. Remember that with the engine out and prop windmilling, the glide will be considerably steeper than the normal engine-idle glide. Tune in 121.5 and declare an emergency and give your intended landing site. Shut off the fuel valve. The 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. The glide will be steepened and rate of descent increased with the gear down. Set up the forced landing pattern with the airbrake out and shoot for the middle 1/3 of the forced landing area. Therefore, if you miss judge short, you can retract the airbrake and possibly still make the field. Turn your electrical power off before touchdown to minimize any potential fire hazard. Touchdown as slowly as possible if landing in rough terrain.

IN FLIGHT 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 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*. 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 its actuation system is so simple, failure to extend or retract properly is 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. A smooth paved surface is far better than rough grass. If the brakes are applied aggressively after the nose is down, the nose bumper will be ground down with NO fiberglass damage. If you apply no breaks, there will be fiberglass damage. The only other gear emergency to be considered is a flat tire. If it is necessary to land with a flat/blown main tire, make a normal landing touchdown near the side of the runway with the good tire. Use ailerons to hold the weight off the flat tire. Lower the nose and use brakes for directional control. Never attempt to takeoff with a low tire. All tires loose air pressure with time. Because of the small size of the nose tire, it loses tire pressure faster then the mains and should be checked before every flight. *Takeoff or landing with low tire pressure will likely destroy the tire and create an emergency.*

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 serious emergency. The risk of damage can be minimized by selecting a wide, long runway with a cross wind from the side of the failed brake. The aircraft will weathervane into the wind and, by careful application of the good downwind brake, directional control can be maintained but not to a full stop. Stop the

engine as soon as the mains are down. Idle thrust alone will force the aircraft off the runway.

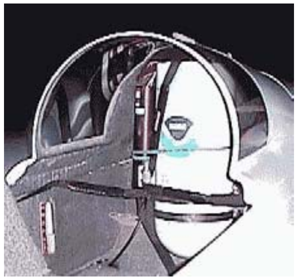
If it becomes obvious the aircraft will leave the runway, it is preferable to retract the nose gear rather than to force a ground-loop. Just turn the nose wheel crank over center and allow the handle to spin as the nose gear retracts. Allow the handle to spin freely so the worm gear will be damaged.

ICING

N3R is NOT approved for flight into known icing conditions. If icing is encountered, it will first show up centered low on the wind screen. Experience proves N3R carries ice well. However, N3R has no deicing equipment. At the start of icing, the pitot heat should be turned on and action should be taken to remove the craft from the icing. Because of N3R's excellent climb-rate and high-altitude performance, climbing above the icing may be a good solution. Descending to warmer air may also be a possibility. When descending to warmer temperatures, be prepared for a scare when the ice departs the canard and passes through the propeller. Reducing RPM to below 1,800 would be a wise choice. A better choice is likely a 180 turn.

EMERGENCY PARACHUTE

During NOAA research missions, N3R also carries a model BRS5C 1200 ballistic parachute recovery system (BRS) which is tied to the airframe to allow safe recovery of the pilot, aircraft and instruments in an emergency. The solid rocket, which deploys the chute, is activated by pulling a handle located above the pilots right shoulder. When activated, the rocket accelerates to 150 feet per second within the first 0.1 seconds ripping through a "blow out patch". In the follow on 0.8 seconds, the rocket extracts the parachute and stretches tight its lines and the airframe harness attachments. FAA certified tests have shown that full parachute inflation occurs as low as 300 feet above the ground. Actual "saves" have occurred below 150 feet. Once under canopy, the rate of descent will be around 15 feet per second. When stabilized, the aircraft will descend in a flight level attitude with the nose slightly lower than the tail. On reaching the ground, the nosewheel will generally touch down first. Fortunately, we have never needed this safety system. However, as of June 1999, 127 lives were spared by actual use in other aircraft.



The chute canister bolts to the forward face of the center section spar. Just above the canister is a thin fiberglass "blow-out" patch consisting of 3 oz fiberglass to allow the chute to exit. The chute is tied to the airframe with a three-point Kevlar harness. One strap ties around the fiberglass gear bow. The other strap runs through the strake and around front of the pilot seat-back. The strap lengths are such that the aircraft would come down in a level attitude.
Some deployment scenarios for using the BRS could include:

- ➜ Catastrophic airframe failure (mid-air collision)
- ➜ Engine failure at night or over inhospitable terrain
- ➜ Pilot incapacitation, and
- ➜ Anytime massive deceleration is needed.

The idea of the parachute is to reduce forward speed and create a survivable vertical impact with the ground. Before chute deployment, airspeed should be traded for altitude and the propeller stopped turning. To deploy, one must pull the activating handle - hard! Before touchdown, the nose gear should be extended and electrical and fuel systems cutoff. For additional information on the use see the BRS, Inc. web page at Html://www.airplaneparachutes.com/index.html.

> **CAUTION!** We have no experience with N3R's BRS. Limit use to catastrophic emergencies where the cost of the aircraft is not the main concern. Obviously, if you can land successfully, this should be your choice. A BRS system is an option of last resort.

406 ELT

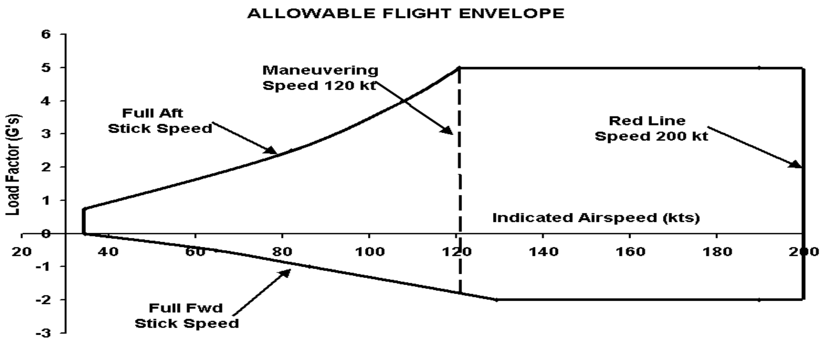
N3R caries the new 406 MHz Emergency Locator Transmitter (ELT). In an emergency, this new generation ELT broadcasts not only on standard civilian and military emergency frequencies but it also sends the aircraft's ID to the stationary GOES satellites. From the GOES down link, search and rescue immediately knows the LongEZ's ELT has alarmed, the aircraft location and phone numbers to call. Unlike the old 121.5 ELT, the 406 is effective. The ELT may be activated by impact or the pilot at any time via a toggle switch located to the left of the master alarm switch. See http://www.sarsat.noaa.gov/ for more information

To insure up to date contact information, the registration must be updated every two years or whenever contact information changes. Registration information can be updated online at the SARSAT home page using N3R unique ID =2DC83 400D0.

LIMITATIONS AND PLACARDS

Placards

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



Solo – Front seat only, minimum pilot weight - 132 pounds

Max gear extension speed	100 knots
Max speed with gear down	140 knots

N3R allows positive aerobatic maneuvers. Aerobatic maneuvers listed below are approved:

Maneuver	Recommended Entry*
Chandelles	130 knots
Lazy Eights	130 knots
Steep Turns	130 knots
Stalls	Slow deceleration
Accelerated Stall	110 knots
Loops	170 knots
Rolls	120 kts
Spins	Prohibited

*Abrupt use of controls is prohibited above 120 knots.

Crosswind component	15 knot takeoff, 20 knot landing.	
Max wind for taxi (all quarters)	40 knots - Canopy closed.	
Fuel tank	100LL 36Gal capacity	
Red line speed	200 knots	
Maneuver speed	120 knots	
Maximum gross weight	1600 pounds	
	1800 pounds (takeoff)	
Center of Gravity limits	Fwd 97.0	Aft 104.0
Max Airbrake Ext. Speed	95 knots	

ENGINE LIMITATIONS (Lyc O-320 E2D)

RPM	2700 Max
CHT	500°F Max
	435°F Continuous
Oil Temp.	245F Max
	180°F Desired
	170°F Min Continuous
Oil Press.	60-90 PSI Normal
	25 PSI idling
Fuel	100 LL (91/96 octane minimum)

PILOT CHECKOUT - EXPERIENCE REQUIREMENTS

There is no such thing as a minimum number of *total hours* a pilot should have to be qualified for checkout solo in a new aircraft. The best pilot qualification is variety. He should be current in more than one type of airplane. N3R 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 N3R's differences. N3R has entirely conventional flying qualities. However, its responsiveness is quicker and its landing speed is faster than most light training aircraft. It should <u>not</u> be considered as a training airplane to develop basic flying proficiency. N3R ranks with the best tricycle-geared types for ground stability and has none of the ground-looping tendencies of the tail-draggers.

1. Checkout should not be done in gusty winds, particularly crosswind conditions.

2. Use runways at least 3500 feet long for initial checkouts. The new 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 the pitch trim system. Let him get used to the pitch and roll feel by flying the rear stick control. Do not transition him to the front seat unless he flies the aircraft smoothly and confidently from the rear seat.

4. For pilots with less than 250 hours, we recommend TEN hours dual instruction with an experienced LongEZ pilot in the back. Another possibility is to complete the Velocity, Inc. canard aircraft ground school and flight transition training.

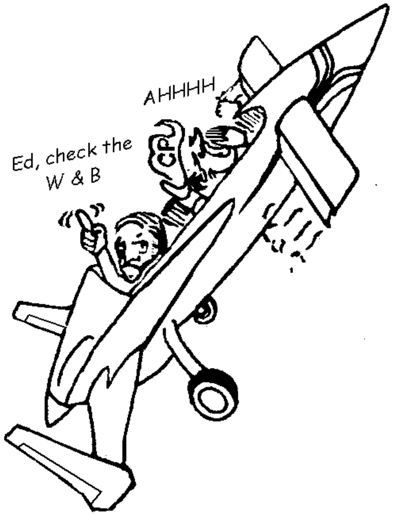
5. Weight and balance should be in the first flight box. However if a choice of one must be exceeded, an overweight condition is preferable to an aft CG condition.

6. Briefing must emphasize that the aircraft should never be rotated past the angle that places the canard on the horizon for takeoff or landing.

7. Pilot being checked out must have a minimum of 10 hours each in at least two type aircraft in the last 4 months (5 in the last 30 days) and feel competent and comfortable during marginal conditions, such as crosswind landings near demonstrated limits, etc.

Just after liftoff, some pilots tend to immediately level off or descend, then re-establish a normal climb. 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 give an over rotation impression. If mentally prepared, the pitch "bobble" is easily prevented: rotate smoothly to liftoff at 65 knots. If you <u>think</u> you have over-rotated do not overreact, don't shove the stick forward. Hold the liftoff attitude and the airplane will accelerate to 80 knots for climb. Occasionally a new pilot will tend to make a "full stall" landing or flare too high. If he makes 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.

WEIGHT AND BALANCE



Loading data and sample weight and balance are shown below. The simple loading graphs provide for routine service use. Fuel loads at the aft CG limit and tend to move the CG back. This is important to allow rotation with heavy fuel loads. The passenger sits near the aft CG limit and has little impact on CC. To develop an accurate CG location, use the below formula (and your pocket calculator) with the weight vs. fuselage station chart.

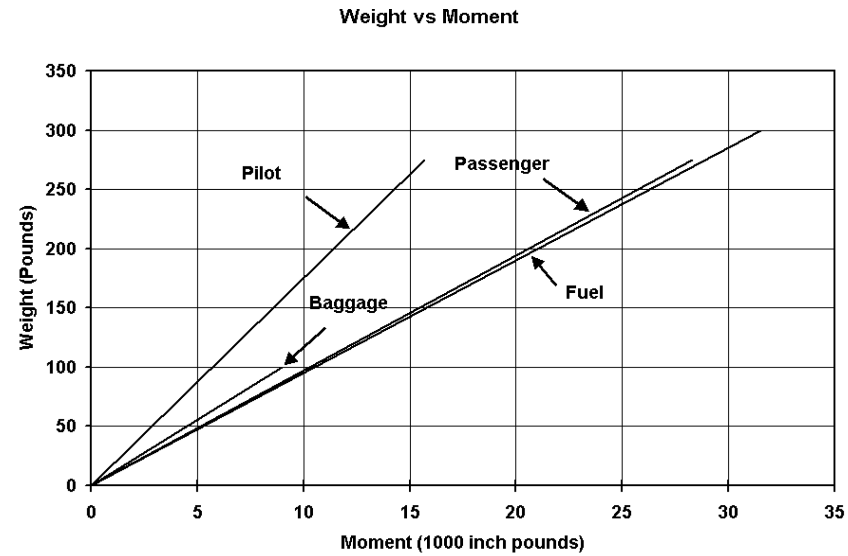
Also, one may add up the weight and moment totals for your load as shown in the sample problems. Then divide the total moment by total weight, to get the loaded CG position fuselage station (inches aft of the datum; F.S. 0.00). For the light pilot sample, total weight is 1113 lb. total moment is 115706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

$$TW = 1043 + P + CP + B + F$$

$$CG = \frac{114696 + 57P + 103Cp + 90B + 104.5F}{TW}$$

Where:

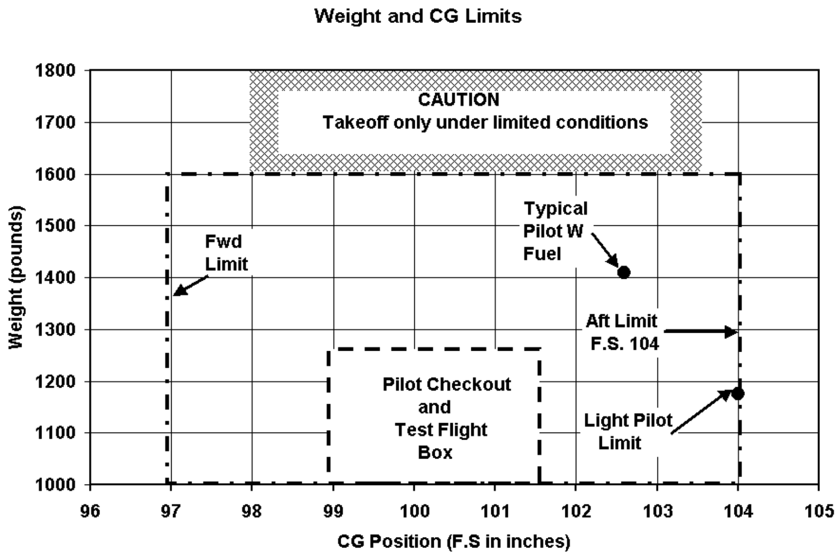
- *TW* is the total weight in pounds
- *CG* is the computed CG location in inches
- *P* is the pilot weight in pounds
- *Cp* is the passenger weight in pounds
- *B* is the baggage weight in pounds, and
- *F* is the fuel weight in pounds (F = 6 x Gallons)



EXAMPLE - N3R - LIGHT PILOT AND NO FUEL			
Item	Weight	Station	Moment
A/C	1043		114,696
Pilot	132	57	7524
Total	1175	104	122,220

EXAMPLE - N3R - TYPICAL, PILOT WITH 4 HOURS FUEL			
Item	Weight	Station	Moment
A/C	1043		114,696
Pilot	175	57	9975
Fuel	192	104.5	20064
Total	1410	102.6	144,735

WEIGHT AND CG LIMITS



MAXIMUM GROSS WEIGHT TAKEOFF

A maximum gross weight, for *takeoff only*, of 1800 pounds may be used, but only under the following strict limitations:

1. Taxi and takeoff only on smooth hard surface. Use the 6 ply premium aircraft tires with 50 PSI inflation.

2. Maximum landing weight limited to 1600 pounds.

3. Maneuvers limited to normal category +3.8 g, -1.0 g. No abrupt maneuvers.

4. Refer to gross weight takeoff distance. Lift off at 70 knots and climb at 95 knots. See the charts in Appendix I.

5. Before conducting over-gross operation, the pilot should be a proficient/competent N3R pilot with at least 50 landings in the aircraft. The pilot should not attempt high gross operations at high density-altitudes or gusty crosswinds. Max crosswind component is 8 knots.

6. High gross weight operations should not be considered a routine operation since the chances of surviving a forced landing off the airport diminish rapidly as weight goes up. It should only be considered on rare occasions when a long range, full fuel two-place operation is desired. Routine operation above 1600 pounds gross weight is not recommended.

7. Study the takeoff performance data and procedures for High Density Altitude Takeoff provided in Appendix I.

CAUTION! Operations above 1600 gross weight is a high-risk activity and hazardous practice!

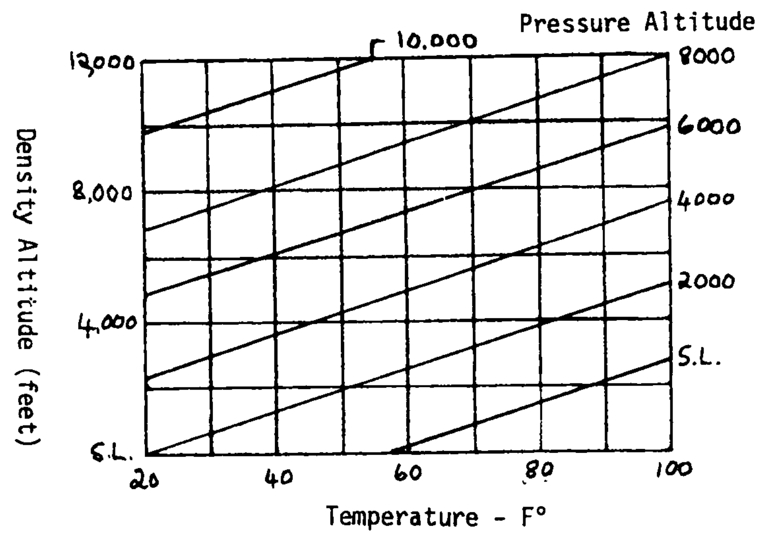
APPENDIX I: PERFORMANCE DATA

N3R's performance is impressive. The following performance was extrapolated from the standard Long-EZ owners manual using aircraft performance theory[1] applied to horsepower and weight of N3R. Study of N3R performance is important to better understand its capabilities and limits Both the Eppler 1230 main wing and Roncz canard were designed to carry extensive (~60% of the chord) laminar boundary layers. Performance is adversely impacted by airfoil contamination. Wings contaminated with dirt, scum and bugs will destroy the laminar boundary layer early and decrease performance. Even minor contamination will reduce cruse speed 5 knots.

CAUTION! The accuracy of this performance data is unknown.

DENSITY ALTITUDE CALCULATION

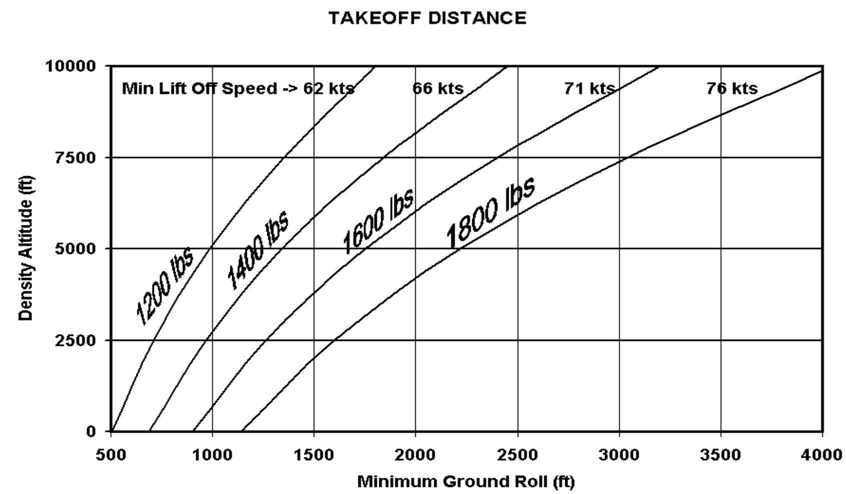
The following graph or N3R's micro-encoder can be used to find density altitude.



[1]Aerodynamics for Naval Aviators by H. H. Hurt, Jr., Issued by the Office of the Chief of Naval Operations Aviation Training Division, NAVWEPS 00-80T-80

TAKEOFF DISTANCES

Many accidents occur during the takeoff. Knowledge about takeoff performance will keep you from scaring yourself and may prevent an accident. High gross weight takeoff is dangerous because takeoff distance grows with weight squared and rotation speed grows with the square root of the weight. From the below chart, it becomes clear why high density altitude takeoff is dangerous at high gross weights.



HIGH DENSITY ALTITUDE TAKEOFF

The combination of high aircraft gross weight and high density altitude represent significant dangers for takeoff obstacle clearance. Special care is required to avoid premature rotation, (ie, if liftoff is too slow, the aircraft will be on the back side of the power curve and may not climb).

When operating heavy and high (say, within 100 lbs of gross weight and above 5,000 ft density altitude) do not fully rotate to liftoff attitude until your airspeed is within 5 knots of the best rate of climb speed, for your specific weight and altitude (see climb charts). This will require more runway than a slower liftoff, but will assure the best capability to clear obstacles and continue a safe climb. Never attempt takeoff under conditions in which you cannot achieve best rate of climb speed while still on the available runway. If this ability is not clear at any point during takeoff - abort. Off-load weight or wait for a cooler time of day.

Lift-off is possible as slow as the "minimum lift-off speed," and can be successfully used at light weights and/or low altitudes to achieve a short ground roll. However, that technique will usually result in inadequate initial climb if used when heavy or high.

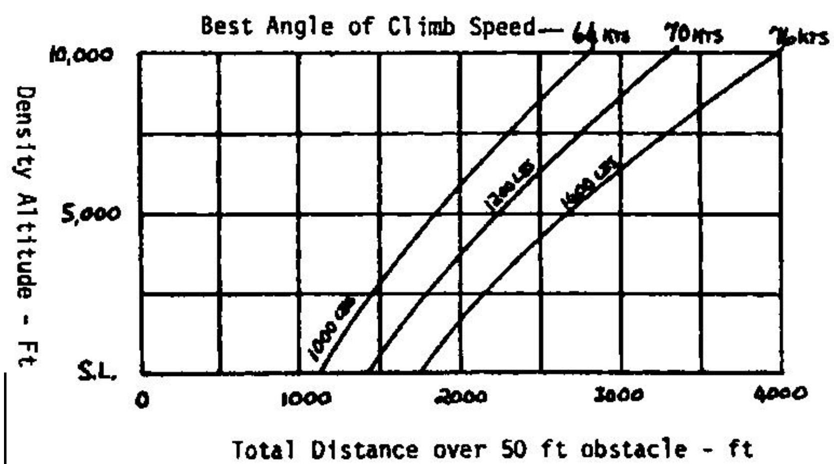
Runway slope effects are minor when light or at low altitudes, but they become very significant when heavy/high. For example, a 1 percent uphill runway slope may add well over 1000 feet to the distance required to clear an obstacle. Never takeoff uphill when your takeoff roll performance is marginal. Never continue a takeoff if crosswinds require you to brake so much that a safe liftoff is in doubt. Always use "best power mixture" for high attitude takeoff conditions. An over-gross weight takeoff that seems like an acceptable operation near sea level can be a real killer when hot and high. Never attempt a takeoff when over 1,800 pounds gross weight. Finally, if the nose-wheel is not up at the half runway point, aborting takeoff is prudent.

The effect of wind on takeoff distance is large. A 7 knot headwind will reduce takeoff distance 19%. However, a 7 knot tail wind will increase takeoff distance 21%. The effect of wind on takeoff, *TDwind*, can be computed from the above takeoff distance *TD* as:

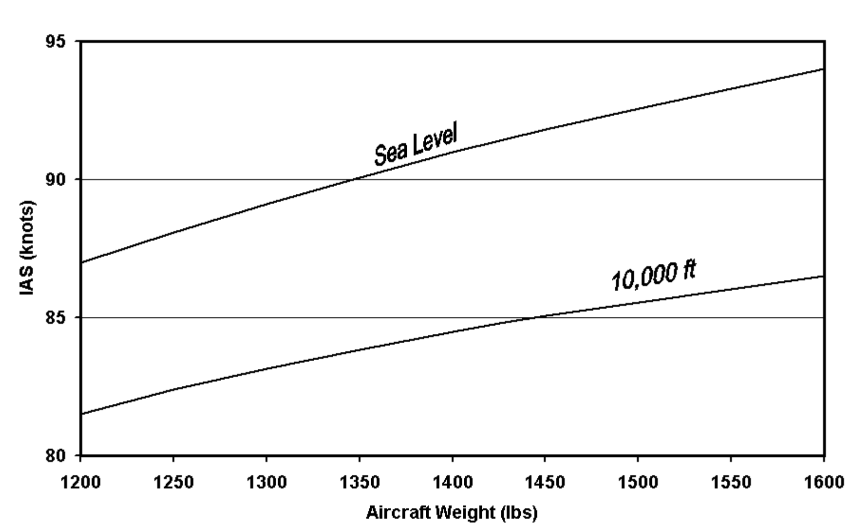
$$TDwind = TD\left[1 - \frac{V}{W}\right]^2$$

Where *V* is the minimum liftoff speed and *W* is the headwind.

The total takeoff distance becomes more exciting if you must also climb over a 50 ft obstacle. The following has not been adjusted for N3R 50% increase in power, so it should be conservative.



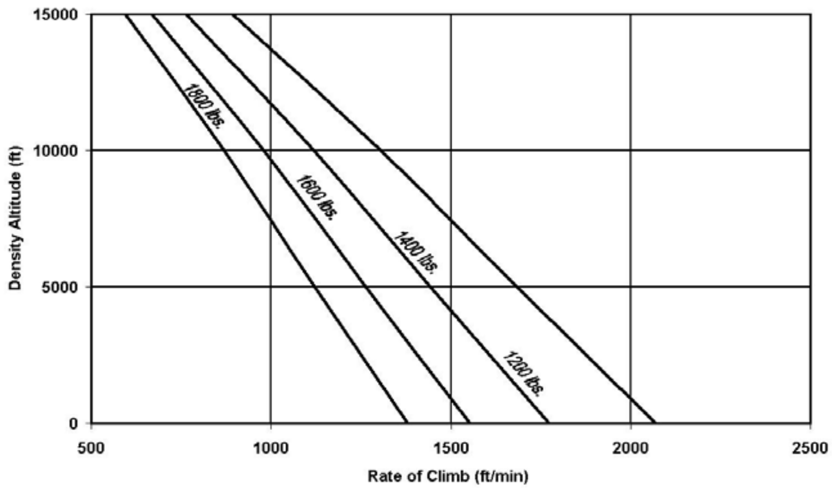
BEST CLIMB SPEED
One of the most important items of climb performance is the maximum rate of climb. This occurs at a specific indicated airspeed. Faster or slower speeds produce less performance. Generally, small speed variations from optimum are not significant. However, climb performance may become critical at high weight, high altitude, or during emergences. N3R has significantly improved climb rate because of its 60% increase in horsepower. However, increased power has little effect on the *speed* at which best angle or best rate occurs. Horsepower directly improves climb rate.



CLIMB PERFORMANCE
Given the best climb speed, this graph gives climb rate depending on density altitude and weight. Weight decreases climb rate for two reasons. First engine power must be used to lift the weight. Second, the weight increases the drag and therefore power required.

NOTE: For best cooling and good visibility, climb 20 kts faster than shown when possible. We typically do a "cruise" climb at 120 knots.

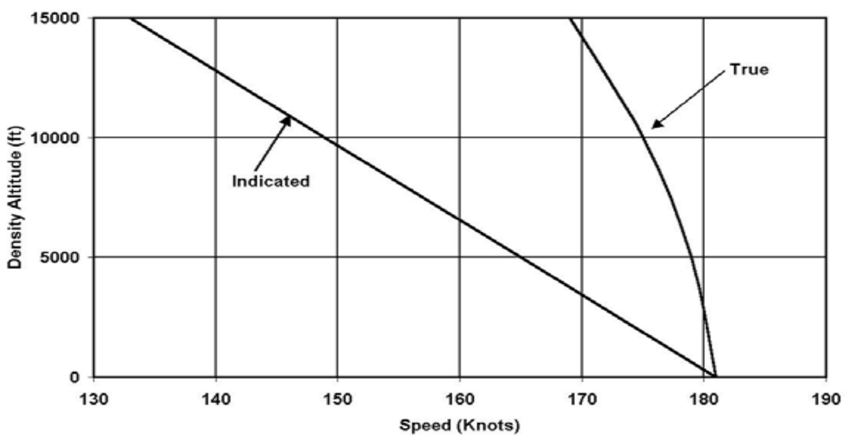
Maximum Climb, Best Power Mixture



MAXIMUM SPEED

The maximum speed for level flight is shown in the following graph. This performance assumes a light aircraft (pilot and 4 hours of fuel), wheel pants and a *clean* aircraft. If the laminar flow wings are dirty or bug covered, subtract 5 knots. If high lift Vortex Generators are installed, subtract 8 knots.

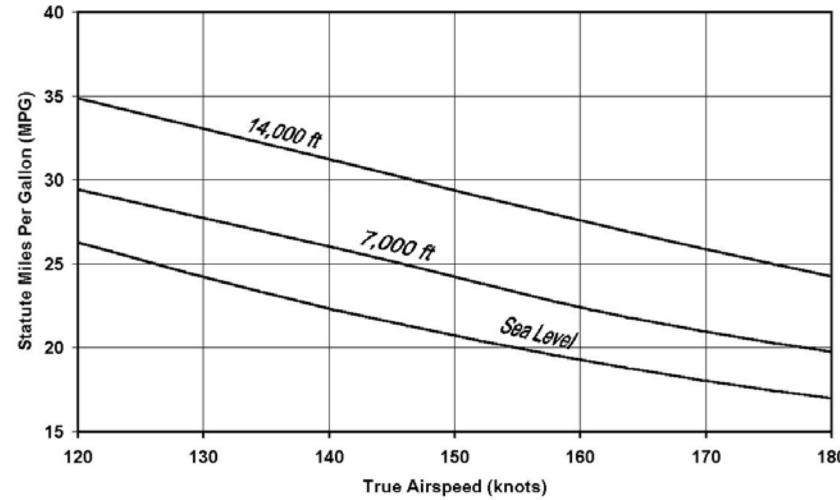
Maximum Speed in Level Flight



FLIGHT PLANNING CHART CRUISE SEGMENT

Few realize the fuel economy benefits available when an engine is leaned to proper "best economy" (BE) settings. Due to cooling requirements, BE setting (50 degrees F of lean side of peak EGT), is allowed only below 65% power. Lycoming supplied data shows that at BE, specific fuel consumption is 14% lower than at "best power" leaning (approximately 90 degrees on rich side of peak EGT). Cruising at full-rich damages the engine, fouls plugs, and burns up to 55% more fuel than at the BE settings! Always lean at least to peak EGT when cruising with less than 65% power.

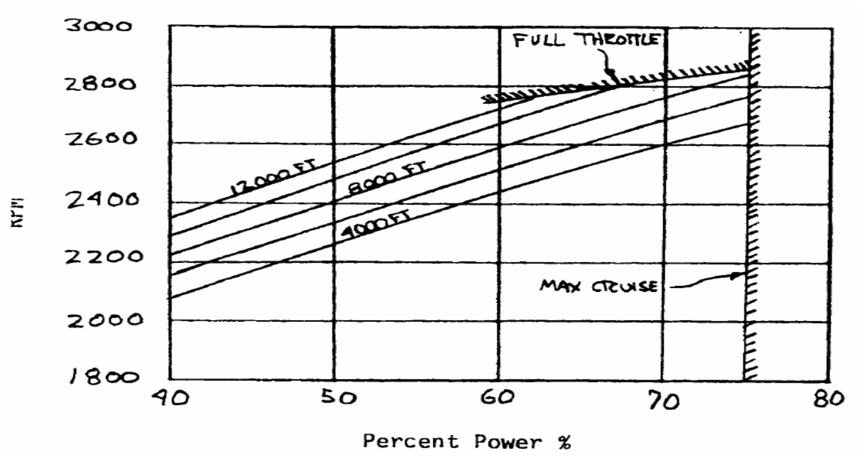
Fuel Economy (MPG)



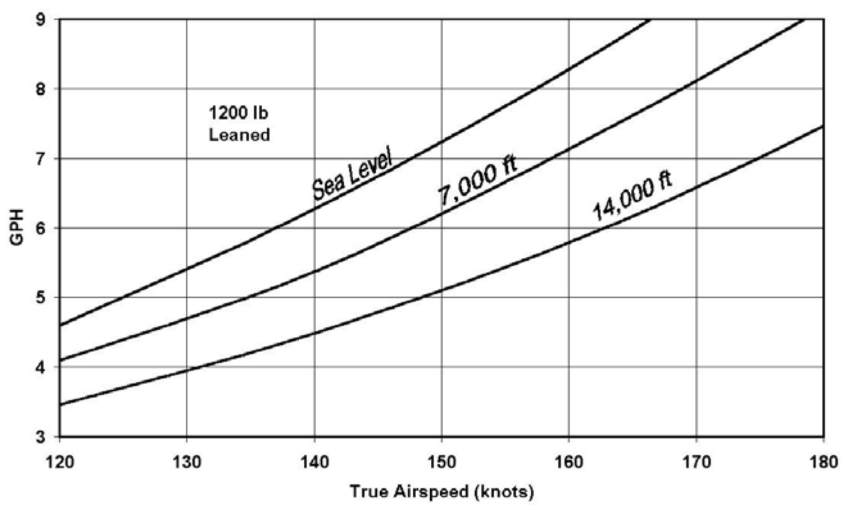
We routinely ferry N3R around 10,000 ft. Leaned 50 RPM below maximum RPM, cruise TAS is ~170 knots and the fuel burn 8 GPH. Heaver weights or dirty wings can reduce cruise TAS up to 5 knots.

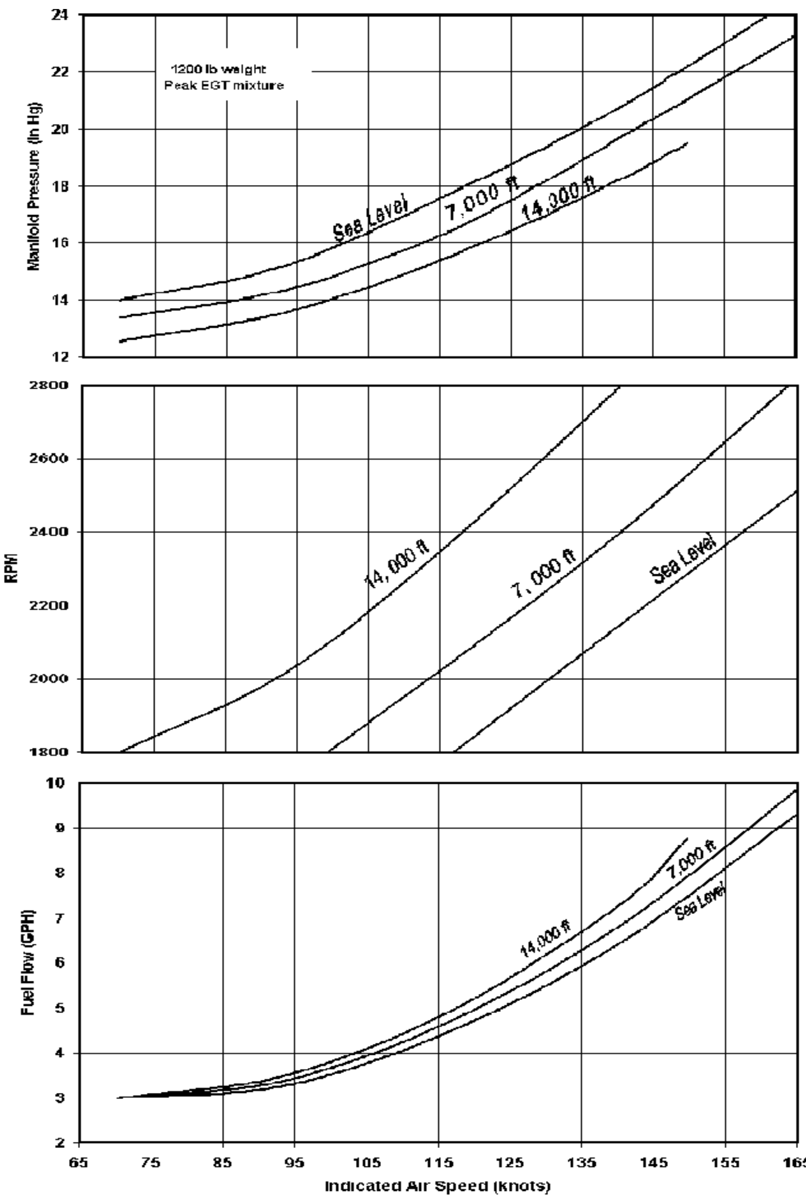
NOTE: Max continuous cruise speed (175 TAS) is obtained at 8500 feet altitude with full throttle (2700 RPM, 8.5 GPH). A good economy cruise condition is 2550 RPM at 12,000 feet altitude (50% power, 6 GPH) resulting in a true airspeed of 155 knots.

Approximate Chart to set Cruise Power.



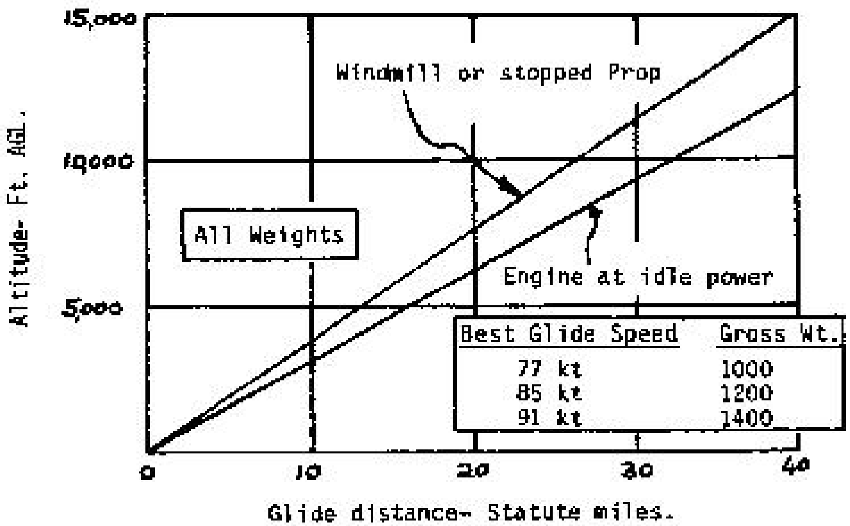
Fuel Burn



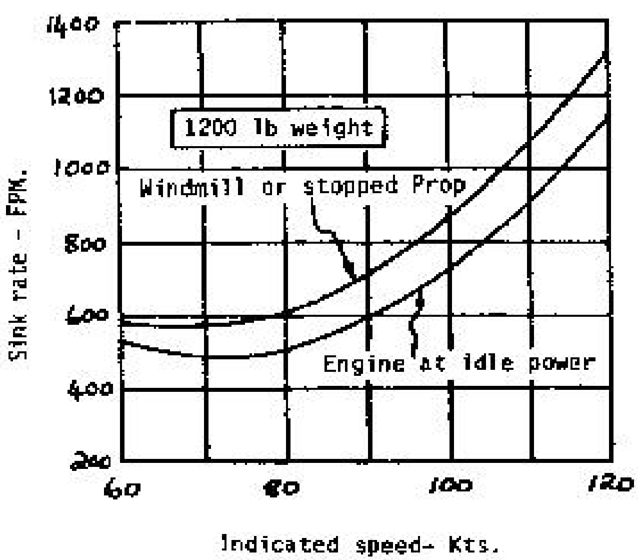


GLIDE – GEAR UP

The original RAF Long-EZ manual provides the following glide performance. N3R should perform similarly.

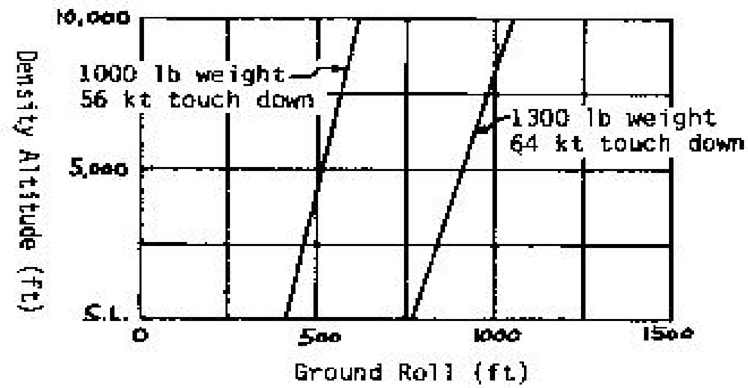


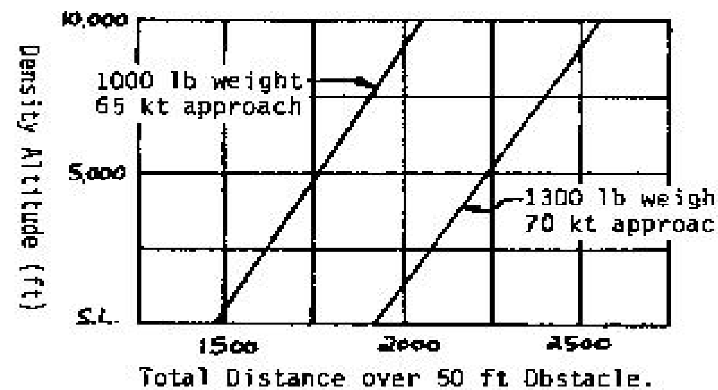
Sink rate- sea level- gear up.

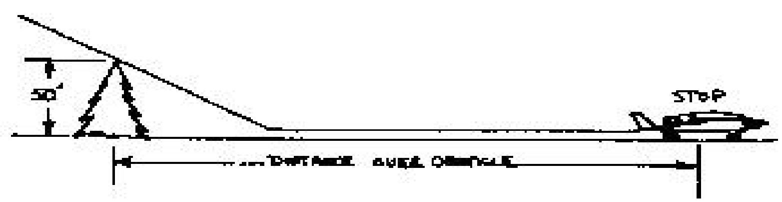


LANDING DISTANCE – Airbrake EXTENDED

N3R has Cleveland's high-energy metallic brake (199-197 model) with 250% more energy adsorbing capacity than the original design. RAF suggested the following for the original design.







APPENDIX II: FLIGHT CHECK LIST

The check list we use is a bit different because of N3R's dual electrical systems and other complexities. Each pilot has tailored the check/list to his needs. Both are available at:
http://www.noaa.inel.gov/Capabilities/longEZ/Safety.asp

Long-EZ N3R Checklist

ENGINE STARTING
Preflight inspection - COMPLETE
Gear - EXTENDED & LOCKED
Seat belts - SECURE
All electrical equipment - OFF
Circuit breakers - Check IN
Master switch - ON
Carb heat - COLD

ENGINE COLD	ENGINE HOT
Mixture - RICH	Mixture - CUTOFF
Lift throttle 3X	DO NOT PRIME!
Primer - 1-5 sec	

Throttle - CRACKED
Magnetos - ON (Left & Right)
Boost pump - ON
Prop - CLEAR
Brakes - HOLD
Engine - START
Mixture - RICH (if hot)
Boost pump - OFF
Alternator switch - ON

TAXI
Fuel caps - LOCKED
Fuel - FULLEST TANK
Controls - FREE & CORRECT
Landing brake - As Required
Lights - as Required
Electronic tachometer - ON
Electronic altimeter - ON
Radio, GPS - ON
DG direction and heading bug - SET
Attitude indicator - SET
Both altimeters - SET

RUN UP
Brakes - HOLD
Throttle - 1700 RPM
Left magneto - OFF, < 100 RPM, ON
Right magneto - OFF, < 100 RPM, ON
Carb heat - ON, < 100 RPM, OFF
Oil pressure - Check > 80 PSI
Alt output - Check POSITIVE
Suction gage - Check 4-6 in HG
Throttle - IDLE

BEFORE TAKEOFF
Canopy - CLOSED & LOCKED
Trim - SET
Mixture - 1/2 LEAN
Carb heat - Check OFF
Magnetos - Check ON (Left & Right)
Transponder - ON, 1200 for VFR
Boost pump - ON
Landing brake - As Required

CLIMB/CRUISE

Gear - UP	Vx = 70 Kts
Boost pump - OFF	Vy = 90 Kts
Fuel - MANAGE	Climb = 110 Kts
Mixture - LEAN as required	

LANDING
At the key:
G - Gas - Select FULLEST TANK
U - Undercarriage - DOWN & LOCKED
M - Mixture - RICH
P - Pump - ON
S - Seat Belts - SECURE
Carb heat - ON
Landing brake - As Required

LANDING SPEEDS
Downwind - 90-100 Kts
Base - 80-90 Kts
Final - 70-80 Kts
Threshold - 65-70 Kts
Touchdown - 60-65 Kts

ENGINE SHUTDOWN
Transponder - OFF
GPS - OFF
Electronic altimeter - OFF
Radio - OFF
Alternator switch - OFF
Mixture - CUTOFF
Magnetos - OFF as engine quits
Master switch - OFF

PARK
Nose gear – RETRACT
Aircraft – TIE DOWN

LANDING BRAKE:
Taxi/Takeoff with Landing Brake EXTENDED if gravel or debris on runway. RETRACT at 60 kts on takeoff.

****

ALARMS - If alarm sounds, check:
CANOPY - CLOSED & LOCKED
GEAR - DOWN & LOCKED (if landing)
GEAR - UP & LOCKED (if cruise)
LANDING BRAKE - RETRACTED (>120 kts)
ALTERNATOR - TURN OFF all unneeded electrical equipment and land as soon as practical.

MIXTURE - Always adjust by going to full rich and leaning to proper setting.
****

APPENDIX III: MAINTENANCE AND INSPECTION

COMPOSITE STRUCTURE

N3R is painted with a UV barrier (dark primer) to protect the epoxy-foam structure, an epoxy sealer and then white Du Pont Emron (817U) polyurethane top-coat. 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 N3R 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 a wrinkle in the skin, remove the paint around the crack (by sanding) and inspect the glass structure. Do *not* use paint remover. If the glass structure is damaged, it will have a white appearing ridge or notch indicating torn (tension) or crushed (compression) fibers. If there is no glass damage, it will be smooth and transparent when sanded. If there is glass structure damage, repair as shown in Section I of the construction manual. Delaminations are rare. If a delamination occurs (skin trailing edge joints, etc), spread the joint, sand the surfaces dull, trowel in wet flox, clamp back together and let cure, or use the method in the construction manual. (See CP71-5)

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

WARNING - The foam core in composite control surfaces, wings, canard and winglets is easily damaged by solvents, including solvents found in paint primer, most cleaning products and, of course, oils and fuel. Never wash the structure with anything but soap and water. The smallest invisible pinhole through the epoxy surface structure can allow intrusion of liquids or vapors that will attack the Styrofoam core. A void or dis-bond (separation from the skin) will weaken the structure and can result in a fatal accident. The foam core can also be damaged by local concentrated loads such as a dropped tool or by using your shoulder to set the gear. Never use a wing as a workbench or to stack luggage. Treat all composite skins like eggshells. Pressing hard on the wings with elbows will leave a permanent indentation.

PLEXIGLASS CANOPY

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

After 16 years, N3R's canopy still looks new. This is because we keep it covered and always clean it with *lots* of water to flush dirt particles instead of making a grinding compound. It is cleaned frequently with a *very* mild abrasive (we use 3M's Finesse-it). Wax is not used because there are no scratches to cover.

BRAKES

Good brake maintenance is critical because the brakes are essential for steering and therefore landing and taxi safety. Every other annual, the system should be disassembled, inspected and cleaned. O-rings which are warn or damaged should be replaced. Break pads and disks which do not meet tolerance specifications should be replaced. Only 5606 (red) brake fluid should be used. Refer to Celevland's wheel and brake Component Maintenance Manual for detailed maintenance/overhaul procedures for their 199-197 wheel and brake conversion kit. Technical information is available at http://www.parker.com/cleveland and 1-800-272-5464. The following is a short summary containing specific limits and torques to be used in wheel and brake service.

Lining - The minimum replacement thickness on metallic 066-06200 lining is 0.100 inch. When new linings have been installed, it is important to condition them properly to obtain the service life designed into them.

1. Perform two (2) consecutive full stop braking applications from 30 to 35 knots. Do not allow the brake discs to cool substantially between the stops.
2. Allow the brakes to cool for 10 to 15 minutes.
3. Apply brakes and check for restraint at high static throttle. If brakes hold, conditioning is complete.
4. If brakes cannot hold aircraft during static run-up, allow brakes to cool completely and repeat steps 1 through 3.

Wheel - The 40-151 wheel assembly tie bolt and nut torque values is 90 in lb and is to be applied to the nut only as a dry torque only.

Disk - The disc faces should be checked for wear grooves, deep scratches, excessive general pitting or coning of the brake disc. Coning beyond 0.015 inch in either direction would be cause for replacement. Single or isolated grooves up to 0.030 inch deep should not be cause for replacement, although general grooving of the disc faces will reduce lining life. Also. The disk should be replaced when they are warn thinner than 0.325 inch.

Brake assembly - Use a torque wrench when installing the 30-164 brake assembly back plate bolts to insure the proper torque values are attained. Replace the back plate tie bolts with approved bolts as shown in the Cleveland Product Catalog. The back plate dry torque is 75 to 80 in lb

The wheel bearings should be cleaned and lubricated with Grease per MIL-G-81322 (Aeroshell 22 or Mobil 28). The axil nut torque is 40 in-lb.

PROPELLER

Mounting Procedure - Apply a light coat of beeswax or paraffin wax to drive lugs and center stud extension. Care should be taken to keep propeller hub face parallel to the flange face while tightening the bolts. Note that the propeller extension, extension cover, propeller, crush plate and spinner are all keyed and assembled at a specific clock-angle.

Torque - Torque to 40 foot pounds with the tracking procedure. New propellers must be checked after the first flight is completed. Then, recheck every 10 hours until completion of 50 hours. Then, check torque every 25 hours.

Tracking Procedure- Carefully track the propeller and get it perfect. Do not settle for 1/16" being close enough. Tighten all bolts to 20 foot pounds. Check the track. Continue to torque down 5 foot pounds between tracking checks. Stop at an average of 40 foot pounds ±5 foot pounds across the hub to get perfect track. If this does not establish perfect track, the hub must be shimmed.

As a tracking tool, place a stick on wing held in place with a bean (shot) bag. Align the stick one inch from end of the prop. Rotate prop to determine if prop to stick gap is equal and track is equal. If not tracking exactly, a slight variation can be corrected with slight (± 5 ft-lb) differential torque. If the track error is too large, a piece of paper folder stock may be used as a shim between prop flange and prop face to even up track.

Propeller Care - Automotive cleaners and paste waxes can be used to clean the finish. No other care is necessary.

Rock Damage - Light impact damage can be repaired with two part epoxy filler available in tubes. Always carry JB Weld or a Duro epoxy kit. Fill small chip holes and small voids, clamp with a rubber band over plastic until cured. Sand the repair to contour. Although the epoxy is very dense, the amount of imbalance resulting from small repairs is negligible.

Plastic Leading Edge - The polyurethane leading edge is effective in preventing small rock damage. However, if damaged, it too can be easily repaired with JB or epoxy.

Painting Outer Tips - If you wish to paint the outer three or four inches of the tips, make sure an equal amount of paint is applied on each side to maintain the balance. If refinished, use a clear two-part polyurethane and check static balance between applications.

Dynamic balance - Ideally, the prop should be dynamically balanced during annual to better than 0.1 ips.

CAUTION! Bolts do not hold propellers on. Torque does -- torque imposes the essential flange to propeller force that generates static friction which allows the engine power pulses to be adsorbed without motion. If the torque in insufficient, the heat resulting from prop to flange motion will ash the prop at its hub interface and then break the bolts and drop the prop.

Recheck torque every 25 hours, and before next flight when a transition is made from a wet climate (high humidity) to dry conditions. Wood shrinkage in dry environment can reduce torque and result in an in-flight loss of the entire propeller.

SCHEDULES, MAINTENANCE, AND 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.

EACH 25 HOURS

Every 25 hours, clean the aircraft, inspect the structure and complete the 25 hour check list. A 25 hour check list is provided below.

Conduct a general inspection of all composite structure. Any visible crack must be investigated to determine if it is only paint and filler damage or if it extends into the fiberglass structure. All paint and filler cracks should be repaired or sealed to prevent water intrusion. All fiberglass damage must be re-painted before flight. Check skin surfaces for evidence of depressions or bulges that indicate a failure of the underlying foam core. Note the integrity of the underlying core by pushing on the skin and tapping testing.

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

➜Fuselage, wing/canard - 3" diameter.

➜Winglet, control surface - 2" diameter.

Repair per instructions in the annual/100 hour below.

ANNUAL / 100 HOURS

Accomplish all the items listed in the annual / 100 hour check list, plus all items in Appendix IV except weight and balance.

Conduct a very careful 100% skin surface coin tap, surface stiffness and contour smoothness inspection. Include interior areas in fuselage, cowl and wing with wings removed. Repair all suspect areas (even 1" diameter ones) by drilling #50 holes and injecting epoxy in one side of the void/bulge/dent area until the epoxy vents out the bulge. The bulge can be minimized by clamping or weighting the surface. Any divergence from the intended smooth contour must also be repaired and reinforced per the standard repair methods in the plans.

Every other annual, remove both wings 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 is given a thorough structural inspection.

CANARD REMOVAL AND INSTALLATION

The canard can be removed in 15 minutes. Tools required: 1/4", 3/8" and 7/16” wrenches. 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 VOR antenna and unhook both pitch trim springs on the right side of the cockpit. Disconnect the auto pilot pitch servo by removing the 3/8" nut holding the actuating push-rod in place. Remove the elevator control push rod 3/16" bolt on left 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 backup wrench is required. There are

no washers behind the canard lift tabs and the bulkhead. Carefully lift the canard up and forward. Set the canard upside down on foam blocks or soft material as to not scratch the surface. Be especially careful of the elevator pushrod that it does not get kicked/bent.

To install the canard, 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 slide the canard into position. Be careful *not* to get the VOR 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 so the bolts will tighten without bottoming prematurely in the nut plate. These bolts should be snugged well (about 30 in-pounds) but not over-tightened. Reconnect the auto pilot, VOR antenna, pitch trim springs, and elevator push rod. Perform an operational checks on the VOR, trim, A/P and elevator systems. Recheck the AN-4 bolts (in and torqued).

WING REMOVAL

To remove/install the wing you must have an assistant. This operation should take no more than 15 minutes per wing. Tools required: screwdriver (for cowl removal), 3/4” & 3/8” drive sockets, short extensions, and one 3/8” drive ratchet.

Procedure: Remove the cowling, disconnect the aileron pushrod and the rudder cable. Disconnect the nav/strobe light and antenna wires. Remove the three wing access attach covers. Remove the three main wing attach bolts. To remove the two outboard bolts, use the ratchet on the wing side. The single inboard bolts access is from inside the cowling area in the wing root. Access to the bolt is from the inside the centersection spar accessible from inside the back cockpit. These bolts are locktight’ed in place and should not turn.

After the three main wing attach nuts are removed, slide the wing aft and off the aircraft. The wing comes off and on easily when properly supported and the strake to wing-root gap is uniform. Set the wing on foam blocks or soft material to protect the surface from damage. The procedure is the same for both wings.

> **CAUTION!** Be sure the nose is ballasted so the aircraft will not fall over backwards while working on it, especially if the canard is removed.

> **NOTE:** Do not change the number or position of ***any*** incidence shim washer on the ½" bolts. These shims washers control the incidence of the wings and should be replaced ***exactly*** as they come off. For safety, reinstall the nuts while the wing is off to protect shim arrangement.

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 its tail. Recheck for the correct number of incidence shims on each bolt. Torque the bolts to 25 foot-pounds. Be sure to hook up and run a complete operational check of the ailerons, rudder, and lights prior to flight.

TORQUE AND SPECIFICATIONS

TORQUES		SPECIFICATIONS	
Wheel Back plate Main Axel Nut Nose Axel Nut	90 in-lb 75-80 in-lb 40 in-lb 90 in-lb	Cleveland brake/wheel Lining Disk Wheel Brake Assembly	P/N 199-197 P/N 066-06200 P/N 164-08500 P/N 40-151 P/N 30-164
Spark Plug	30 ft-lb	Main (50 psi) Nose (40 psi)	Airhawk 5.00-5/6ply McCreary 2.8/2.50
Oil Screen	90 in-lb		
Wing 1/2" Canard 1/4"	30 ft-lb 30 in-lb		
Starter Cable	10 ft/lbs		
Main Gear attach	23 ft-lbs		
Propeller	40 ft-lb		
Max Torque (inch-pound) (Shear load - use half max)			
AN6 390 AN3 40 AN7 840 AN4 100 AN8 1100 AN5 225		Eng rubber mt	Lord J-9613-19

25Hr INSPECTION CHECK LIST

Wide-Body LongEZ N3R

ENGINE

- ☐ Cowl – Remove and check baffling for cracks.
- ☐ Inspect engine for oil or fuel leaks.
- ☐ Thoroughly clean the engine.
- ☐ Inspect cables, push rods, fuel/oil lines and electrical wires.
- ☐ Change Oil -Clean & inspect screen every other oil change.
- ☐ Air Filter – Check and replace (if necessary).
- ☐ Exhaust System – Check for cracks, leaks, and security.
- ☐ Fuel Filters – Remove and clean gascolator.
- ☐ Fuel System – pressure check (electric pump on) for leaks.
- ☐ Prop bolts – Check torque (40 foot-pounds).
- ☐ Inspect the prop and spinner for damage/cracks.
- ☐ Run – check for leaks, idle speed/mixture and mixture cutoff.
- ☐ Remove ALL tools and install cowl.

AIRFRAME

- ☐ Thoroughly clean the aircraft while inspecting structure
- ☐ Tires and brakes – Remove wheel pants, check tire inflation 50 PSI main tires, cuts, wear, and brake pucks for wear.
- ☐ Landing gear attachment – Check for security or damage.
- ☐ Nose wheel -Check condition and 45 PSI. Adjust nose wheel friction damper for 2-4 pounds. Side force should be required to swivel the pivot.
- ☐ Nose gear retraction – Check for damage, and wear
- ☐ Fuel vents – Check open
- ☐ Canopy – Check hinges, locking mechanism for rig/snub, safety catch operation.
- ☐ Warning system - check operation
- ☐ Lights – Navigation, landing, strobe, cockpit, check operation.

Log work in N3R's logbook

ANNUAL INSPECTION CHECK LIST

Wide-Body LongEZ N3R

Date:___________ INSPECTOR:__________________

HOBBS:______hr FAA Cert. No.:_________________

BEFORE INITIAL INSPECTION
- ☐ Review the Canard for outstanding safety issues.
- ☐ Search http://www.rutanaircraft.com for safety issues.
- ☐ Search & Comply with AD's & Service Letters.
- ☐ Review the W&B and equipment list for currency.
- ☐ Remove access covers, wheel pants and cowling.
- ☐ Inspect engine for oil or fuel leaks.
- ☐ Thoroughly clean the aircraft and engine.

FUSELAGE -- COCKPIT GROUP INSPECTION
- ☐ Inspect fiberglass for deterioration or evidence of failure.
- ☐ Inspect cabin for cleanliness & items that might foul the controls.
- ☐ Inspect speed brake for condition, fit, security and operation.
- ☐ Inspect seat harness for poor condition and attach security.
- ☐ Inspect canopy, hinges, latches and safety catch for damage and proper function.
- ☐ Inspect instruments condition, mounting, marking and operation.
- ☐ Inspect flight & engine controls for proper installation and oper.
- ☐ Inspect pitch trim control operation and installation & lubricate.
- ☐ Inspect pitch trim control operation and installation.
- ☐ Inspect ELT for proper installation, signal, operation & battery date _______

FUSELAGE – NOSE GROUP INSPECTION
- ☐ Remove canard (see manual instructions).
- ☐ Inspect fiberglass for deterioration or evidence of failure.
- ☐ Inspect 25AH battery for proper installation, condition.
- ☐ Inspect landing light actuation mechanism and wiring.
- ☐ Inspect rudder pedals, rudder cables, and master cylinder.
- ☐ Inspect oil cooler and lines running aft.
- ☐ Inspect nose gear retract mechanism then grease worm gear and worm with light grease.
- ☐ Inspect security on all actuating mechanism hardware.
- ☐ Verify proper nose gear warning micro switch operation and condition of switch & wire.

ENGINE AND FIRE WALL GROUP INSPECTION
- ☐ Change oil & inspect screens for metal or foreign material.
- ☐ Inspect studs & nuts proper torque and obvious defects.
- ☐ Compression #1-___/80 #2-___/80 #3-___/80 #4-___/80.
- ☐ Clean or replace spark plugs and gap (.030").
- ☐ Inspect engine mount for cracks & engine or mount looseness.
- ☐ Inspect Lord mounts for condition and deterioration.
- ☐ Inspect secondary battery, electrical wires, and 8A alternator.
- ☐ Inspect engine controls for defects, travel, and proper safety then lubricate.
- ☐ Inspect lines, hoses & clamps for leaks, condition & looseness.
- ☐ Inspect exhaust stacks for leaks, cracks, defects, and security.
- ☐ Check 65A alternator bearings for smoothness, mount security and belt condition.
- ☐ Inspect carburetor heat box & install new air filter.
- ☐ Inspect electrical wires for condition and signs of chafing.
- ☐ Inspect cowling baffles condition and that they fit tightly.
- ☐ Run engine: Check for leaks, ignition function, idle speed, mixture cutoff.
- ☐ Inspect condition of ignition wires and electronic ignition timing.
- ☐ Inspect cowling for cracks and defects.

PROPELLER GROUP INSPECTION
- ☐ Remove spinner and prop, checking for condition.
- ☐ Check propeller extension for torque and signs of cracks.
- ☐ Install propeller torque to 40 ± 5 ft-lbs.
- ☐ Check prop track (±1/16") & dynamic balance (<0.05ips).

LANDING GROUP INSPECTION - MAIN GEAR.
- ☐ Clean, inspect & repack wheel bearings and safety.
- ☐ Service brakes and inspect for condition, function & safety.
- ☐ Check brake line for damage & condition of heat shield.
- ☐ Check rudder travel (4.5 " measured at bottom).
- ☐ Check main gear strut attachment (cf. CP47, Pg. 9).
- ☐ Check tires for wear for proper inflation (50 psi).
- ☐ Check for proper main tire toe-in (1/4 - 1/2˚ each side)

LANDING GROUP INSPECTION - NOSE GEAR.
- ☐ Clean, inspect & repack wheel bearing.
- ☐ Inspect axle nut for security and proper installation.
- ☐ Inspect nose gear tire condition and inflate 40 psi.
- ☐ Inspect shimmy damper friction adjustment -2-4 lbs side force. Inspect for damage, wear.
- ☐ Inspect and secure on all actuating mechanism hardware.

☐ Hold nose up and cycle gear, verify proper function & locking.

FUEL SYSTEM INSPECTION

☐ Clean, inspect & apply fuel lube to fuel caps.
☐ Inspect fuel tank vent system; open, no leaks.
☐ Inspect gascolator, clean filter & safety.
☐ Inspect fuel line condition.
☐ Inspect primer valve and lines.
☐ Inspect and clean carburetor finger screen.
☐ Drain Carb bowl. If trash found in bowl or screens, disassemble and clean.
☐ Pressure check fuel system with electric pump on for leaks.

CONTROL SYSTEM INSPECTION

☐ Inspect elevator/aileron push rods for proper installation & wear.
☐ Inspect elevator/aileron push rods for freedom of movement throughout control travel.
☐ Inspect pitch trim springs and mechanism for function and freedom of movement.
☐ Inspect elevator and aileron hinge attachment screws for safety and jamb nut installation.
☐ Inspect elevator and aileron for freedom of movement without binding or chafing.
☐ Inspect rudder pedals for freedom of movement, cable attachments and return to neutral.
☐ Inspect rudder pulleys and cables and cable guard.
☐ Inspect all rod ends and lubricate.
☐ Inspect cables, control rods for chafing.
☐ Inspect for >1/16" clearances about all mass balances.

INSTRUMENTATION - ELECTRICAL INSPECTION

☐ Check pitot/static systems for leaks.
☐ Inspect radio antenna connections.
☐ Inspect wiring for chafing.
☐ Check lights: navigation, landing, strobe, cockpit.

MAIN WING GROUP INSPECTION

☐ Inspect surfaces for damage, cracks, delamination.
☐ Inspect fuel tanks for leaks, water.
☐ Inspect nav lights, strobes for operation, security.
☐ Inspect rudder hinges, bell horns, springs and attachments.
☐ Inspect winglet skins for damage, cracks delamination.(CP71-5)
☐ Inspect elevator hinges and attachments.
☐ Check ailerons for proper mass balance (0 to 10˚ nose down).

☐ Lube & Inspect ailerons, hinges, cables, pulleys & bell cranks.
☐ Remove wings & inspect attach fittings for cracks or delaminations (every other annual).
☐ Inspect wing attach bolts, lube and torque to 30 ft. lb.

CANARD GROUP INSPECTION

☐ Inspect canard lift tabs, elevator torque tubes, bolts and nut-plates condition.
☐ Inspect canard surfaces for damage, cracks, delamination.
☐ Check elevator weights for security and test elevators for 12˚ to 25˚ nose down balance.
☐ Inspect controls and rodends for condition and lubricate.
☐ Check security on all actuating mechanism hardware.
☐ Install canard (torque 30 inch-pound) checking elevator travel 22˚ ± 2˚ down to 20˚ ± 2˚ up.

☐ Log inspection in N3R's Logbook

APPENDIX IV: AIRCRAFT SYSTEMS CHECKOUT

The following procedure should be used for system checkout after each annual inspection.

GENERAL

☐ Check all fasteners for proper security and safetying.
☐ Check canard attachment for security and proper installation.
☐ Check wing attachment bolts, and nuts for 25 ft lb torque.
☐ Check wing and canard incidence:
  Canard incidence with Roncz "G" template
  Wing incidence within 0.3° incidence of each other.
  within ± 0.5° with incidence templates.
☐ Check control surface deflections:
  Rudder - 4-1/2" measured at the bottom of the rudder relative to the lower winglet trailing edge. Measure this with pilot holding full rudder pedal while applying 5 pound force inboard on the rudder trailing edge.

  Elevator - travel 30°± 2° trailing edge down
  13°± 2° trailing edge up
  Ailerons - must both fair into wing at trailing edge when neutral. At full deflection aileron T.E. must travel 2.1" ± 0.3" at inboard end (measure relative to wing T.E.)
☐ Control surface mass balance:
  Elevators for proper mass balance – 12° to 25° nose down. Weight evenly distributed between inboard and outboard locations. Max elevator weights with mass balances installed are 3.9 pounds left and 3.6 pounds right. Check this!
☐ Ailerons for proper mass balance
  level to 10° nose down.

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 aileron pushrods for freedom of movement throughout control travel.
☐ Pitch trim mechanisms for 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.
☐ Cable clearance throughout control travel.
☐ Brake actuating cable freedom.
☐ All rodends – Reject any with evidence of bent tangs.
☐ Check for 1/16" minimum clearances all around 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 secured.
☐ Check tires for 45-50 psi inflation.
☐ Adjust brakes and test for proper function. Service with fluid as required.
☐ Double check for proper main tire toe-in (1/4° to 1/2° per side).
☐ Wheel bearing packed with grease and safetied.

Nose Gear

☐ Nose gear tire inflation, 40 PSI.
☐ Wheel bearing grease and safety.
☐ Axle nut for security and proper installation.
☐ Shimmy damper for frictional adjustment (two to four pound side force at axle is required to rotate pivot).
☐ Check safety and security on all actuating mechanism hardware.
☐ Light grease on worm and worm gear.
☐ Hold nose up and cycle gear to verify proper function and locking. Verify an over center condition on the NG50. Cycle gear with a 10-pound load to simulate air drag load.
☐ Verify nose gear warning micro-switch is activated in the last 1/10" of NG50 travel and that the alarm system works.

INSTRUMENTATION

☐ Perform a leak check on the Pitot and static systems.
☐ Perform a functional check on the initial engine run of the oil pressure and tachometer gauges.

POWERPLANT
- ☐ Propeller bolts for proper torque (40 ft lb) and safety.
- ☐ Propeller track and cracks.
- ☐ Spinner tracks and cracks.
- ☐ Engine mount bolts for security and safety.
- ☐ Oil level.
- ☐ Mixture, throttle, and carburetor heat controls for security and proper function.
- ☐ Cowling baffles must fit tight all around the engine and cowl.

FUEL SYSTEM
- ☐ Check that the fuel caps seal securely and the vent system is clear without leaks. Clean the fuel caps o-rings and lub with fuel lub.
- ☐ Check fuel filter and carburetor filter (at carb inlet) for contamination.

WEIGHT AND BALANCE

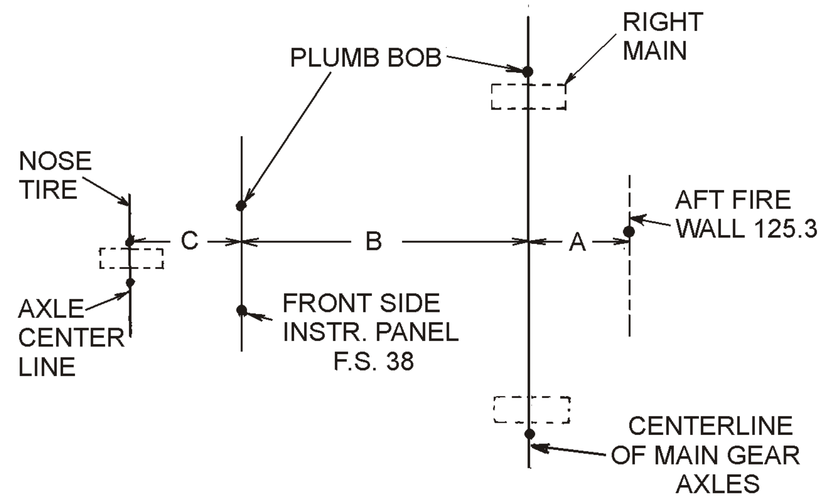
Periodically, the weight and balance should be checked as it is very important. The measurements taken should be recorded in the airframe logbook and used in the weight and balance data kept aboard the airplane.

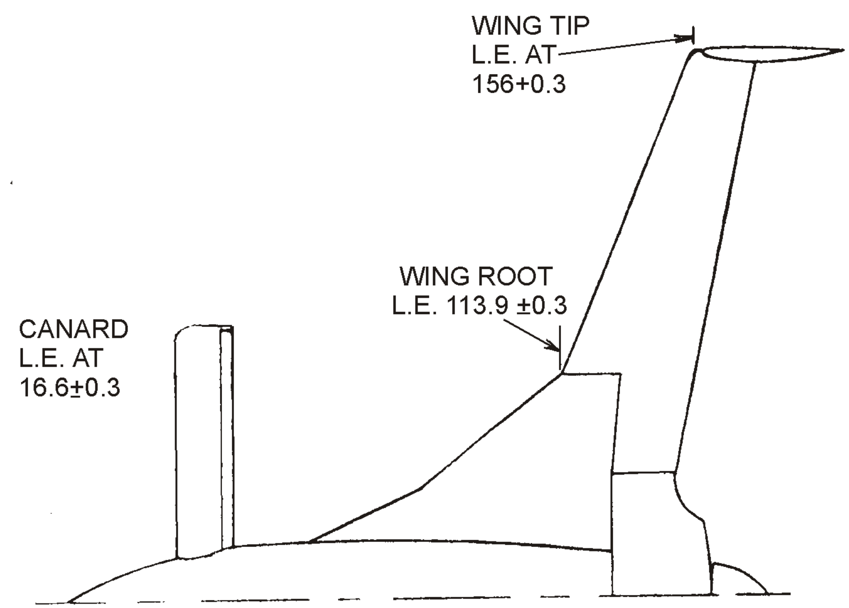
Equipment required: three scales – electronic platform type is nice. Align the scales or use grease plates to avoid side loading the scales. A 12-foot decimal tape measure, a plumb bob and line, are needed to check measurements. Ballast to the nose down on the scales with the landing gear extended. Check the scale accuracy with a known weight.

Position the airplane on the scales with the W.L. reference (top longeron) level. 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 the plumb line to mark the positions of the main and nose-gear axle center lines on the shop floor with chalk. Also drop a line from the front edge of the instrument panel and aft fire wall. Take measurements A, B, and C shown below.

Measuring relative to both the firewall and instrument panel provides a double check on the critical arm lengths. These checks are done with the plumb-bob to the floor. Note that the CG limits relative to the wing are the important reference, not the instrument panel or fire wall. The main gear is at F.S. 110.5” to allow correct rotation speed and ground handling. If the gear location is determined to be elsewhere, investigation of the gear for creep and mount damage is necessary.

MEASURING REACTIONS FOR WEIGHT & BALANCE





To get the moment arm (fuselage station) of your main gear, <u>add</u> dimension A (in inches) to 38.0. To get the nosegear arm, subtract dimension B (in inches) from 40.0 (it should be at about F.S. 20). Be sure to weigh and record the ballast weight and next make a tabulation as shown.

EXAMPLE – N3R's 1st Weight & Balance – June 28, 1986			
ITEM	Net	ARM	MOMENT
R. Main	492	110.5	54366
L. Main	487	110.5	53813.5
Nose	-5	4	-20
Ballast	-18	104.5	-1881
Total	956	111.2	105278.5

Divide total moment by total net weight to get empty CG (111.2). Remember to subtract the weight and moment of the ballast.

Use the loading charts in the Weight and Balance section and try several sample problems with different pilot weights, fuel loads, and passenger weights to develop an understanding of N3R's loading capability.

When loading the aircraft for test flights or pilot checkout, for safety, it is desirable that the weight and CG fall in the first flight box. However if a choice of one must be exceeded, an overweight condition is preferable to an aft CG condition.

APPENDIX V: FAA RECORDS

Wide-Body LongEZ N3R has a Special Airworthiness Certificate under the classification Experimental. The records required to fly N3R are basically the same as for any production airplane (F.A.R. 91). The airworthiness certificate is required to be displayed in the cockpit, along with the aircraft registration certificate, weight and balance record, and operating limitations. Airframe and engine logbooks 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 requires re-licensing and issuance of a new airworthiness certificate and operating limitations instead of using FAA form 337A.

In addition, FAR 91 requires several items to be certified or inspected at various time intervals. These are listed below.

Item	Period	Comment
Annual Condition Inspection	1 yr	FAR 43 Appendix D
Encoder & Altimeter Check	2 yr	FAR 91.411 & 91.413
ELT Operation	1 yr	FAR 91.207 (d)
406 ELT Battery	5 yr	FAR 91.207 (c)
BRS - Parachute	6 yr	Repack - 4/08
BRS - Rocket motor	12 yr	Replace
O2 System	3yr 12yr	Hydrostatic test Replace
Inst, Equ and A/C airworthy	Always	FAR 91.xxx

AIRWORTHINESS DIRECTIVES

Both RAF and Lycoming publish airworthiness information. For the engine, Lycoming has published more than 300 Airworthiness Directives (AD's), Service Bulletins (SB's), Service Letters (SL), and Service Instructions (SI) which apply to the Lycoming O, IO, LIO, AIO, AEIO-320 series engine. Although compliance with AD's is not mandatory for experimental aircraft, it is prudent. We document N3R's compliance with airframe and engine safety notices at www.noaa.inel.gov.capabilities/longez/safety.asp

EQUIPMENT LIST

N3R is well equipped with radios, navigation and engine instrumentation. The following tables specify the specifics of the installation.

Electronic Navigation and Radio Instrumentation		
Instrument	Model and Serial Number	Weight
Storm Scope Antenna	BFG WX-900 S/N 10100813 BFG 52D54 S/N A1697G	1.56 lb 0.92 lb
NAV/COM ILS VOR/LOC Converter	King KX-155 S/N 50870 KI-209 King KN72/KN75	5.3 lb 1.3 lb
NAV/COM	Narco Escort II S/N 10379	
IFR GPS	II Morrow Apollo 2001 NMS	3.6 lb
Intercom	PS Eng PM 2000	.75
Transponder	Collins TDR 950 P/N 622 2092-001	2.0 lb
Marker Beacon	RST-521 S/N 3485-734	0.4 lb
Radar Alt Antenna	Terra TRI-30 P/N 0900-303-00 S/N 422 Terra 3000 P/N 00900-3000-00 S/N 743	1 lb 1.8 lb
Encoder	RST μ-Encoder	1.5 lb
406 ELT	ARTEX 110-406NAV	4.5 lb

Note: Either the Radar Altimeter or Storm Scope can be installed because of panel space limitations. Currently the storm scope does not function because of ignition noise interference. Additional shielding is required.

Gyros and Flight Instruments		
Airspeed		
Turn Coordinator	S-Tec 6405	1.8
Attitude Gyro	RC Allen RCA15AK-1 (electric)	
Slaved Horizontal Situation Indicator	STC-180/Head 6443 Remote Gyro 6441 Slave Panel 01171 Flux Gate Sensor 6446	2.9 lbs 3.4 lbs 0.3 lbs 0.1 lbs
Altimeter	Century 671 S/N 34769	
Vertical Card Compass	PAI-700-14	
2-Axis Auto Pilot	S-Tec Sys 50 P/N 0131-0-1 S/N291 S-Tec R Servo 0105-4-R2 S-Tec P. Servo 0107-3-P6	2.8 lbs

Engine Instrumentation		
Manifold Pressure	UMA 7-100-2 S/NA1670	
Dual Amp/Volt meter	Westach K2AD10-21	
Volt Meter	(Backup buss)	
RPM	ElectroAir	
Ignition Timing	ElectroAir	
Dual EGT/CHT	Westach 2DA1	
Dual Oil Temp/Pres	Westach 2D3MM	
Dual Fuel Level Electronic Sensors	Westac 2DA4V SkySport 2P121WF	
Fuel Computer Turbine flow sensor	Zemco P/N 3107 FlowScan 100A	
Engine Hour Meter	Hobbs 15000	

The following table is provided to document equipment changes that effect weight and balance. The weight and balance given in this manual is current with the above listed equipment.

Date	S	Item	Weight	Arm	Moment

S = Status of Equipment - X - Installed O – Removed