



Legacy

PILOT'S OPERATING
HANDBOOK
and
AIRPLANE FLIGHT MANUAL
for the



LEGACY

Mfgr's Serial No. _____

Registration No. _____

Owners will need to develop a Pilot's Operating Handbook as part of the aircraft airworthiness process, and are encouraged to modify this document to help in that process.



Legacy

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and

AIRPLANE FLIGHT MANUAL

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Log of Revisions

[illegible]

INTRODUCTION

This Lancair International Pilot's Operating Handbook and Airplane Flight Manual is in the format and contains most data recommended in the GAMA (General Aviation Manufacturers Association) Handbook Specification Number 1. Use of this specification provides the pilot the same type data in the same place in all of the handbooks.

For example, attention is called to Section X, SAFETY INFORMATION. We feel it is very important to have this information in a condensed and readily available location and format for the pilots immediate use when needed.

This SAFETY INFORMATION should be read and studied by all operators of the Lancair Legacy aircraft and will provide a periodic review of good piloting techniques for this aircraft. This manual will not replace safe flight instruction or good piloting techniques.

NOTE

Owner modifications to your Lancair may alter the applicability of this handbook which meets the GAMA specification #1 for pilots operating handbooks.

WARNING

Use only genuine Lancair approved parts obtained from authorized Lancair dealers when repairing and maintaining your Lancair Legacy.

Lancair parts are produced and inspected under controlled procedures to ensure airworthiness commensurate with use in the Lancair. Other than these approved parts, while appearing suitable, may not have been fabricated under adequately controlled conditions and may be unsuitable and dangerous when used in our Lancair.

Lancair and its dealers expressly disclaim any responsibility for malfunctions, failures, damage or injury caused by the use of non-approved parts.

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GENERAL

SECTION 1

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THANK YOU...

You have obtained what we feel is the latest state-of-the-art in a high performance general aviation aircraft. Its performance is spectacular and its life almost beyond measure given reasonable care. A team of outstanding craftsmen has been assembled to design and produce quality aircraft components which can serve you well for years to come. We encourage you to become familiar with this handbook as well as the FARs that are applicable to your operation. The combination will provide you with safe and sound knowledge for operation of your personally manufactured Lancair.

IMPORTANT NOTICE

This handbook should be read carefully by the owner or operator(s) of your Lancair in order to become familiar with its operation and to obtain all it has to offer in terms of both speed and reliability. Herein are suggestions and recommendations to help you obtain safe performance without sacrificing economy. You are encouraged to operate your machine in accordance with and within the limits identified in this Pilot's Operating Handbook and Airplane Flight Manual as well as any placards located in the airplane.

Again, another reminder- the operator should also be familiar with the Federal Aviation Regulations as applicable to the operation and maintenance of experimental aircraft and FAR Part 91 General Operating and Flight Rules. The aircraft should be operated and maintained in accordance with any FAA Airworthiness Directives which may be issued against it. It is also prudent and mandatory to operate within any established limits or Service Bulletins.

The FARs place the responsibility for the maintenance of this airplane on the owner and the operator who must ensure that all maintenance is accomplished by the owner or qualified mechanics in conformity with all airworthiness requirements established for this airplane.

All limits, procedures, safety practices, time limits, servicing, and maintenance requirements contained in this handbook are considered necessary for the continued airworthiness of this airplane, in a condition equal to that of its original manufacture.

Authorized Service Facilities can provide recommended service, repair, or operating procedures issued by both the FAA and Lancair International, Inc. to obtain the maximum prudent usefulness and safety from your Lancair Legacy.

USE OF THIS HANDBOOK

The Pilot's Operating Handbook is designed so that necessary documents may be maintained for the safe and efficient operation of your 2-place Lancair. Its loose leaf form allows easy maintenance for updates and revisions, and is also a convenient size for storage and use within the cockpit.

The handbook is in ten basic sections in accordance with the GAMA Specification No.1, Issued 15 February 1975, Revised 1 September 1984, Revision #1.

NOTE

Except as noted, all airspeeds quoted in this handbook are Indicated Airspeeds (IAS) in Knots, and assume zero instrument error .

In an effort to provide as complete coverage as possible of the Lancair Legacy, some optional equipment has been included in the scope of this handbook. However, due to the variety of airplane configurations available, some equipment described and depicted herein may not be included on your specific airplane.

The following information may be provided to the holder of this manual automatically:

1. Original issues and revisions of Service Bulletins
2. Original issues and revisions of Lancair Airplane Flight Manual Supplements
3. Reissues and revisions of Lancair Airplane Flight Manuals, Flight Handbooks, Owner's Manuals, Pilots Operating Manuals, and Pilots Operating Handbooks

NOTICE

Lancair International Incorporated expressly reserves the right to supersede, cancel, and/or declare obsolete, without prior notice, any part, part number, kit or publication referenced herein.

The owner/operator should frequently refer to all supplements, whether STCs (Supplemental Type Certificate) or Lancair Supplements direct from Lancair or its dealers, for appropriate placards, limitations, normal, emergency and other operational procedures for proper operation of their Lancair with any optional equipment installed.

REVISING THIS HANDBOOK

Immediately following the title page is the "Log of Revisions" page (s). The Log of Revision pages are used for maintaining a listing of all effective pages in the handbook (except the SUPPLEMENTS section), and as a record of revisions to these pages. In the lower right corner of the outlined portion of the Log is a box containing a capital letter which denotes the issue or reissue of the handbook. This letter may be suffixed by a number which indicates the numerical revision. When a revision to any information in the handbook is made, a new Log of Revisions will be issued. All Logs of Revisions must be retained in the handbook to provide a current record of material status until a reissue is made.

WARNING

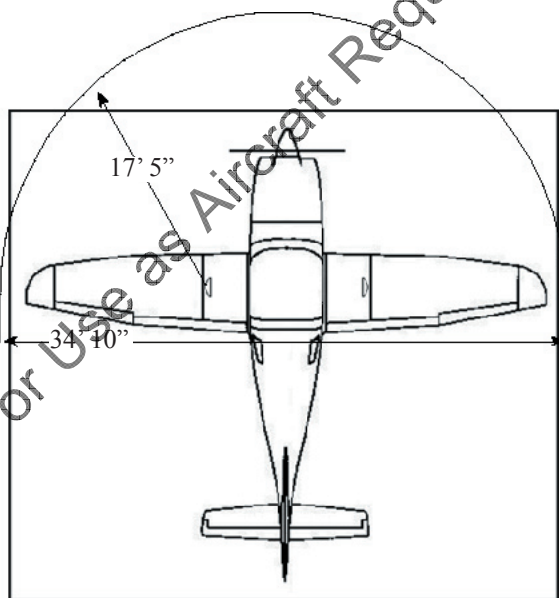
When this handbook is used for airplane operational purposes, it is the pilots responsibility to maintain it in current status.

AIRPLANE FLIGHT MANUAL SUPPLEMENTS REVISION RECORD

Section IX contains the Lancair Airplane Flight Manual Supplements headed by a Log of Supplements page. On the "Log" page is a listing of the Lancair Supplemental Equipment available for installation on the airplane. When new supplements are received or existing supplements are revised, a new "Log" page will replace the previous one, since it contains a listing of all previous approvals, plus the new approval. The supplemental material will be added to the grouping in accordance with the descriptive listing.

NOTE

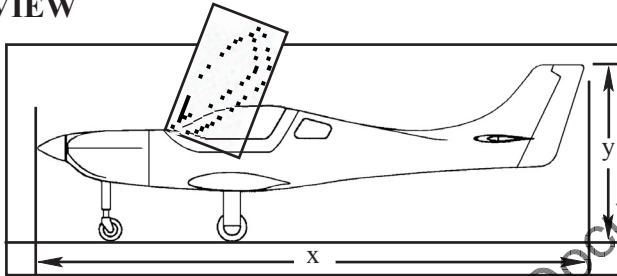
Upon receipt of a new or revised supplement, compare the “Log of Revisions” page just received with the existing Log page in the manual. Retain only the new page with the latest date on the bottom of the page and discard the old one.



Absolute Minimum Turning Radius

LEGACY THREE VIEW

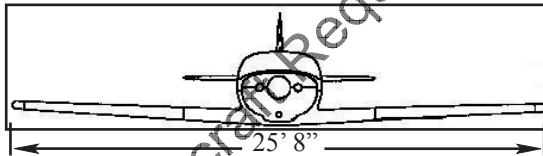
SIDE VIEW



Aircraft Length (x) for 550: 270.25; for 540: 274

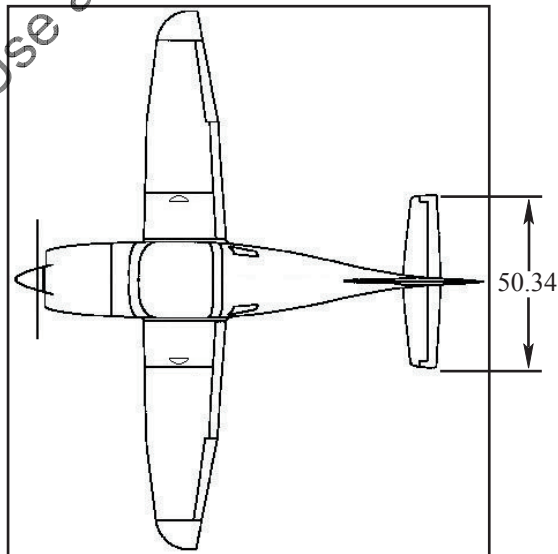
Aircraft Height (y) for 550: 88.25; for 540: 90.5

FRONT VIEW



Note: Above dimension includes strobe lights.

TOP VIEW



DESCRIPTIVE DATA

ENGINES

The Lancair Legacy is designed for either the Continental IO-550-N or the Lycoming IO-540-V4A5 engines. Currently Lancair does not support or approve of any other engines.

PROPELLERS

The approved propellers have been tested and the engine-propeller combinations have Supplemental Type Certificates. Lancair does not approve of or support any other propellers.

Propellers for the Continental IO-550-N:

BHC-J2YF-1BF/F7694-4TX

This is a 2-blade constant speed, 69" diameter propeller.

MTV-9-D/183-109

This is a 3-blade constant speed composite 72" diameter propeller.

Note the larger diameter and keep in mind the ground clearance is reduced by 1-1/2".

Propellers for the Lycoming IO-540-V4A5:

HC-F2YR-1F/F7694-4T

This is a 2-blade constant speed, 69" diameter propeller.

NOTE

Other propellers which are approved are listed by Lancair and its dealers or are approved by Supplemental Type Certificate

FUELS

Standard Fuel System Capacity 64 gallons

Standard Fuel Type 100LL (Blue in Color)

OIL CAPACITIES

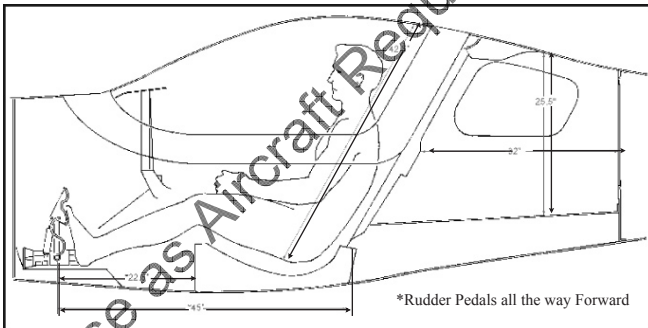
IO-540-V4A5.....	8 quarts (U.S.)
IO-550-N.....	8 quarts (U.S.)

CABIN AND ENTRY DIMENSIONS

Length - 45"
Height - 42.5"
Width - 41"

BAGGAGE

Compartment Volume: 11 ft. ³



SPECIFIC LOADINGS (Max Take-off Wt)

Wing Loading:

At 2,200 lbs: 26.7 lbs./sq.ft.

Power Loading:

At 2,200 lbs.:

Lycoming IO 540 V4A5:	8.5 lbs./hp
Continental IO 550-N:	7.1 lbs./hp

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

CAS	Calibrated Airspeed is the indicated speed of an airplane, corrected for “position error” and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
GS	Ground Speed is the speed of an airplane relative to the ground.
IAS	Indicated Air Speed is the speed of an airplane as shown on the airspeed indicator. IAS values published in this handbook assume zero instrument error.
KCAS	Calibrated Airspeed expressed in “knots”.
KIAS	Indicated Airspeed expressed in “knots”.
TAS	True Airspeed is the airspeed relative to undisturbed air which is the CAS corrected for altitude and temperature.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{FE}	Maximum Flap Extend Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an airplane can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{NE}	Never Exceed Speed is the speed limit that may not be exceeded at any time.
V_{NO} V_C	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

V_y Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

METEOROLOGICAL TERMINOLOGY

ISA. International Standard Atmosphere in which

- 1) The air is a dry perfect gas;
- 2) The temperature at sea level is 15° Celsius (59° Fahrenheit);
- 3) The temperature gradient from sea level to the altitude at which the outside air temperature is -56.5°C (-69.7°F) is -0.00198°C (-0.003566°F) per foot and zero above that altitude.

OAT (Outside Air Temperature) The free air static temperature, obtained either from inflight temperature indicators adjusted for instrument error and compressibility effects, or ground meteorological sources.

Pressure Altitude The altitude read from an altimeter when the barometric subscale has been set to 29.92 inches Hg or 1013.2 millibars.

Station Pressure Actual atmospheric pressure at field elevation.

Wind The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

POWER TERMINOLOGY

Take-off and Maximum Continuous The highest power rating not limited by time.

Cruise Climb The power recommended for cruise climb.

ENGINE CONTROLS/INSTRUMENTS

Throttle Control. Used to control power by introducing fuel-air mixture into the intake passages of the engine. Settings are reflected by readings on the manifold pressure gauge or RPM for fixed pitch propellers.

Propeller Control. Connected to the propeller governor. It is used to maintain engine/propeller RPM at a selected value by controlling blade angle.

Mixture Control. This control is used to set fuel flow in all modes of operation and cuts off fuel completely for engine shutdown.

EGT (Exhaust Gas Temperature). This indicator is used to identify the lean and best power fuel flow for various power settings.

CHT (Cylinder Head Temperature). The indicator used to identify the operating temperature of the engines' cylinder(s).

Tachometer. Indicates the RPM of the engine/ propeller.

Propeller Governor. Regulates the RPM of the engine by increasing or decreasing the propeller pitch through a pitch change mechanism in the propeller hub.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Climb Gradient. The ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.

Demonstrated Crosswind Velocity. The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during take-off and landing was actually demonstrated. The value shown is considered to be limiting. The value in this handbook is that demonstrated by Lancair test pilots and considered safe.

MEA. Minimum enroute IFR altitude.

Route Segment. A part of a route. Each end of that part is identified by:

- 1) a geographical location; or
- 2) a point at which a definite radio fix can be established.

GPH. Gallons per hour fuel flow.

PPH. Pounds per hour fuel flow.

WEIGHT AND BALANCE TERMINOLOGY

Reference Datum. An imaginary vertical plane from which all horizontal distances are measured for balance purposes.

Station. A location along the airplane fuselage usually given in terms of distance from the reference datum.

Arm. The horizontal distance from the reference datum to the center of gravity (GG) of an item.

Moment. The product of the weight of an item multiplied by its arm. (Moment divided by a constant may be used to simplify balance calculations by reducing the number of digits).

Airplane Center of Gravity (CG). The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.

CG Arm. The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.

CG limits. The extreme center of gravity locations within which the airplane must be operated at a given weight.

Usable Fuel. The fuel available for flight planning purposes.

Unusable Fuel. Fuel remaining after a runout test has been completed.

Standard Empty Weight. Weight of a standard airplane including unusable fuel, full operating fluids and full oil.

Basic Empty Weight. Standard empty weight plus any optional equipment.

Useful Load. Difference between take-off weight, or ramp weight if applicable, and basic empty weight.

Maximum Take-off Weight. Maximum weight approved for the start of the take-off run.

Maximum Landing Weight. Maximum weight approved for the landing touchdown.

Maximum Zero Fuel Weight. The maximum allowable weight of the aircraft without fuel. In other words, the weight of aircraft minus the fuel on board should not exceed this figure.

Tare. The weight of chocks, blocks, stands, etc. used on the scales when weighing an airplane.

Jack Points. Points on the airplane identified by the manufacturer as suitable for supporting the airplane for weighing or other purposes.



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LIMITATIONS

SECTION II

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GENERAL

The data approved by Lancair International, Inc. and the Limitations presented herein are those established by Lancair as applicable to the Lancair Legacy.

This section follows the format approved by the GAMA Specification #1, and is intended to provide operating guidelines and limitations specific to the Lancair aircraft only. All airspeeds quoted are given conventional nomenclature, are shown in knots, calibrated airspeed, and assume zero instrument error.

NOTE

It is imperative that you calibrate your airspeed system (static and pitot) to provide the corrections to the values shown below in KCAS. If there is instrument (gauge) error that needs to be factored in also to reach KIAS.

AIRCRAFT OPERATING SPEEDS

Lancair Legacy

SPEED	MARKING	KCAS
Never Exceed Speed	V_{NE} Red Line	274
Maneuvering Speed	V_M	170 @ Gross 2200 lbs. 158 @ 1900 lbs. 140 @ 1500 lbs.
Normal Oper Range	V_{NO} Green Arc	220
Full Flap Oper Range	V_{FE} White Arc	120
Flaps 10° or less		170

POWERPLANT LIMITATIONS

Engines

The Lancair Legacy is powered by standard aircraft engines, the power varying from 260 to 325 HP. They are horizontally opposed, air cooled, six cylinder engines made by Textron Lycoming and Teledyne Continental.

OPERATING LIMITATIONS

Operating limitations for the engines supported by Lancair for use in the Lancair Legacy are shown below. If your engine differs, you must account for that. In addition, the data and limits shown is for new specification engines and does not reflect any degradation due to age or number and quality of overhauls.

Performance will vary obviously depending on the engine/propeller combination as well. Fixed pitch propellers will have significant effects on takeoff and cruise capabilities, for example.

Lancair Legacy Powered by IO-550-N Engine

Specification:

Max Continuous RPM

310 hp at 2700 rpm

77% Cruise, 240 hp at 2500 rpm

Cylinder Heat Temperatures

Maximum (short time period), 460°F (238 °C)

Recommended Max Temperature @ Cruise 380°F.

Oil Temperatures

Maximum, 240°F (115°C)

Normal, 170°F-200°F

Minimum (take-off), 100°F

Oil Pressure

Maximum (cold), 100 psi

Normal Operation, 30-60 psi

Minimum Operating (idle), 10 psi

Fuel Flow

max., .52 BSFC/26.7 gph

77% cruise, .46 BSFC/18.7 gph

Vacuum Pressure

Normal Operating Range, 4.8 - 5.2 in.hg.

Lancair Legacy Powered by IO-540-V4A5 Engine

Specification:

Maximum Continuous RPM

260 hp at 2700 rpm (.51 BSFC)

75% Rated Power, 195 hp @ 2450 rpm (15 gph)

60% Rated Power, 155 hp @ 2350 rpm (12.0 gph)

Cylinder Head Temperatures

Maximum (short time period), 500°F (260°C)

Maximum (above 75%), 475°F

Maximum (below 75%), 435°F

Oil Temperatures

Maximum, 245°F

Normal, 180°F-220°F

Minimum (takeoff) 90°F

Oil Pressures

Maximum, starting & warm up, 115 psi

Normal Operation, 55-95 psi

Minimum Operating (idle), 25 psi

Fuel Pressure (at engine driven fuel pump)

Maximum, 35 psi

Minimum, 12 psi

Fuel Pressure (at inlet to fuel injector)

Maximum, 45 psi

Minimum, 14 psi

Vacuum Pressure

Normal Operating Range, 4.8-5.2 in.Hg.

FUEL GRADES (Aviation Gasoline)

Only 100LL. Blue in color.

OIL SPECIFICATION

Follow the engine manufacturer's recommendations. Following initial break-in of the engine it should be operated with an ashless dispersant oil (MIL-L-22851) conforming to the applicable engine handbook. Break-in (the first 50 hours or until oil consumption has stabilized) should be accomplished using a corrosion preventative oil or straight mineral oil. Low power settings (less than 65-75%) should be avoided during the break-in period and the oil level checked frequently.

Also Refer to Engine Handbook.

OIL TEMPERATURE

Caution (Yellow Radial) 200 to 240°F

Normal Oper Range (Green arc)..... 140 to 190°F

Maximum (Red radial) 245°F

HYDRAULIC PRESSURE

(Not normally monitored)

Gear up..... Approximately 1000 psi. to 1,200 psi

Gear down..... Approximately 600 psi

WEIGHT LIMITS

Maximum Take-off Weight..... 2200 lbs

Maximum Landing Weight..... 2200 lbs

Maximum Zero Fuel Weight..... 1900 lbs

Standard Empty Weight..... 1450 lbs

* Maximum Baggage Weight..... 75 lbs

* Check your C.G. calculations.

CENTER OF GRAVITY LIMITS:

Refer to Section VI.

MEAN AERODYNAMIC CHORD

The center of gravity (CG) is referenced in terms of the mean aerodynamic chord. Refer to section VI for the weight and balance instructions.

MANEUVER LIMITS

The Lancair Legacy is licensed as **EXPERIMENTAL**. Spins are not recommended. Aerobatic maneuvers which have been flown by Lancair test pilots are shown in the chart below. Care must be used and smooth control inputs used at all times when performing aerobatics, and instruction in the maneuvers is considered virtually mandatory. A parachute is FAA required, and no baggage should be carried while performing aerobatics. A thorough preflight should be conducted for loose items in the aircraft, and in the cockpit in particular. Another thorough post flight inspection of the aircraft is also recommended.

DEMONSTRATED MANEUVERS

WARNING: AEROBATICS NOT APPROVED

MANEUVER	ENTRY SPEED	MAX G'S
Chandelle	140 Kts	1.5
Lazy Eight	170 Kts	1.5
Stalls (not whip stalls)*	-	0.0 to 1.5
Aileron Rolls*	180 Kts	-1.0 to 1.0
Barrel Rolls	200 Kts	1.0
Split-S	100 Kts	3.5

* WARNING

Since these engines do not have an inverted oil system extreme care must be used during low or negative “G” maneuvers. Lack of oil pressure will cause the propeller to go to flat pitch and engine overspeed will result. Transient oil pressure conditions near zero must be limited to less than two (2) seconds.

NOTE

Speeds shown are calibrated. Corrections must be applied from a calibration of your aircraft to determine your proper entry indicated airspeeds.

All pilots are again reminded that instruction in aerobatics in the Lanfair is highly desirable. Speed buildup during these maneuvers can be rapid and proper control usage is essential throughout the maneuver to remain within limits.

FLIGHT LOAD FACTOR LIMITS

Flaps up, at gross weight +4.4, to -2.2 g's

Flaps down, at gross weight..... +2 to 0 g's

TYPES OF OPERATIONS AND LIMITS

The Lancair Legacy is approved for the following types of flight when the required equipment is installed and operations are conducted as defined in the LIMITATIONS section.

1. VFR, day and night
2. IFR, day and night

WARNINGS

1. Flight operations with passengers for hire and
2. Flight into known icing is prohibited.

FUEL QUANTITIES (Approx.)

Left Wing.....	32.0 U.S. gallons
Right Wing.....	32.0 U.S. gallons

NOTE:

Fuel quantity may vary slightly from aircraft to aircraft.

FUEL MANAGEMENT

The Lancair Legacy has two fuel tanks - a left and a right wing fuel tank. The fuel selector valve installed in the center console allows you to select between the left or right tanks or shut the fuel off. Wing tank selection is typically managed by switching every 30 minutes to keep the aircraft within trim.

The electric fuel boost pump is used for starting the engine (high boost). The primary difference between the Lycoming and Continental fuel systems is the use of a single stage electric boost pump for the Lycoming installations and a dual stage for the Continental.

Lycoming installations: Electric boost only has a high boost option. Used for priming prior to engine start, takeoff and emergencies.

Continental installations: Electric high boost and electric low boost. The electric high boost is used for priming the engine and emergencies. The low boost is used for vapor suppression at high altitudes.

In general we do not recommend flying the aircraft unless fuel is visible through the gas caps

SEATING

The Legacy aircraft seats two, side by side, and can be flown from either seat (although dual rudder pedals and brakes are an option on the co-pilot's side).

WINTER OPERATIONS

Winter operations are acceptable with proper oil grades for the operating temperature.

PLACARDS

All switches, lights, controls, adjustments and circuit breakers etc. must be marked with labels identifying what the switch, control, etc. is related to and what the position selects.

Safety related items such as door opening instructions, emergency shut-off, and seat belt/shoulder harness requirements should be placed where obvious and made clearly understandable. An example of this would be the gear emergency extension procedure. It should be placed appropriately near the gear dump valve as well as being available in the EMERGENCY Section of this handbook (Red Tab).

An example of a switch marking is the strobe light switch. It should be labeled as "Strobe" with "On" and "Off" positions identified. Convention is up is "on" and down is "off" for electrical switches. Circuit breakers should be labeled as to their rating, i.e. "5 Amp", "35 Amp", etc.

NOTE

There are two placards which must be installed.

1. The word "EXPERIMENTAL" must be placed where it can be prominently seen upon entry into the cabin. These letters must be at least 3 inches high, and contrast sufficiently to be seen on entry.

2. Passenger Warning Statement. The passenger warning statement should contain the following wording:

Passenger Warning; This aircraft is amateur built and does not comply with the Federal Safety Regulations for “Standard Aircraft.”

In addition, the following are some recommended placards:

In front of the pilot:

Airspeed Limitations	
Max Lndg Gear Ext Speed	140 Kts
Max Flap Ext Speed 10°	170 Kts
Max Full Flaps.....	120 Kts

Near the fuel gauges OR fuel transfer pumps:

_____ Gallons	_____ Gallons
Usable	Usable

Emergency landing gear extension (near gear):

Maximum	90 KIAS
Gear CB (& Gear Relay).....	OUT
Gear Switch.....	DOWN
Gear Dump Valve.....	OPEN
Gear	3 lights
Gear Dump Valve.....	CLOSED

If strobe equipped:

Turn Strobe OFF when Taxiing in
Vicinity of Other Aircraft, or When
Flying in Fog/clouds. Standard Position
Lights to be Used for All Night Operations

Near each canopy latch:

Latch Canopy Before Take-off.
DO NOT OPEN IN FLIGHT

These placards can be photocopied, and laminated if desired and then pasted in a desirable location by the owner. It is recommended that all switches and circuit breakers also be labeled, and a dymo marker works well for that task. Further it is desirable to place all labels and placards such that all text is visible by the pilot when sitting in the cockpit seat. Seat belt must be installed and canopy opening placards should be visible by both occupants.

NOTES:

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NOTES:

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EMERGENCY PROCEDURES

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NOTE

All airspeeds quoted in this section are indicated airspeeds (IAS) and assume zero instrument error. Each aircraft should be calibrated to determine its specific error for various configurations. A Pacer method is suggested, flying against a “known” aircraft.

EMERGENCY AIRSPEEDS

Emerg. Descent (Gr Dn)	122 KIAS then to 150 KIAS
Best Glide	120 KIAS
Landing Appr (w/o Pwr)	110 KIAS

NOTE

The following check-lists are presented to capture in a compact format those pilot tasks requiring rapid action. These check-lists should be kept handy for ready access by the pilot, and he should familiarize him/her self with them before flying the aircraft. Knowledge of the switch, control, gauge, etc. location quickly, even blindfolded, is highly desirable. “Cockpit time” prior to ever flying or after an absence is time prudently spent. Where more time would likely be available, rationale will be added and alternative choices offered. It must be remembered however that each situation will be unique in some manner and must be treated as such.

ENGINE FAILURE

During Take-off Ground Roll/Low Altitude

Maintain control of the aircraft. If runway permits, land and attempt stop on runway. If at low altitudes (less than approximately 700 ft. AGL), pick the most suitable site within 30° off the nose and set up the approach. If time permits, attempt engine start.

Establish	120 KIAS (for best glide)
Declare	EMERGENCY
Check Fuel Pump.....	ON
Fuel Valve	FULLEST TANK
Mixture	RICH
Magneto, Cycle, return to	BOTH
Flaps (when on final)	FULL

Note: With gear down maintain 110 KIAS

In Flight

Establish.....	120 KIAS GLIDE
	Climb to reduce speed if practical
Pick	LANDING SITE
Attempt	AIR START
Low boost fuel pump.....	ON
Fuel Valve	FULLEST TANK
Mixture	RICH
Mags Cycle & return to	BOTH

(Note: If there is not a low boost installed temporarily use a high boost).

If stopped, engage starter and attempt engine start

Declare	EMERGENCY
Give position on active freq, or	121.5
Set transponder to	7700

ROUGH RUNNING ENGINE

Adjust Mixture..... **RICH**

If no improvement carefully lean for improvement as follows:

Reduce power to approx **2100 RPM**
Mags Switch to L, then BOTH, then R,
then to **BEST**
Readjust mixture for **BEST OPERATION**

NOTE

If power is restored and there is any doubt as to the cause of the engine roughness, land at the nearest airport and determine the cause.

ENGINE FIRE

In Flight Determine if fire is electrical (acid smell).

Avionics Master	OFF
Master Switch	OFF
All Radios, lights, etc.....	OFF

If fire/smell clears, turn master switch ON then each item of equipment one at a time, waiting long enough to isolate cause.

If no smell, assume an unknown source and Land as soon as possible, find and correct the cause.

If fire continues:

Throttle	IDLE
Mixture	CUT-OFF
Fuel Shut-off Valve	OFF
Fuel Pump	OFF
Transponder	7700
Radio	“EMERGENCY & LOCATION” (Use active frequency or 121.5)

Land immediately and exit the aircraft.

On ground (engine start or taxi)

Throttle to	IDLE
Mixture	CUT -OFF
Radio, (Twr, Unicorn, etc.)	“EMERGENCY” & “POSITION”
Master Switch	OFF
Magnetos.....	OFF

Continue cranking if during start to pull fire back into the engine. Stop and exit aircraft if taxiing.

EMERGENCY DESCENT

Power to **IDLE**
 Speed Brakes (if equipped)..... **OPEN**
 Propeller to..... **HIGH RPM**
 Gear (upon slowing to 140 kts) **DOWN**
 Maintain (after gear down & locked) .. **150 KIAS**
 Transponder **7700** (or as requested)

MAX. GLIDE CONFIGURATION

Gear..... **UP**
 Establish..... **120 KIAS**
 Flaps..... **UP**
 Propeller..... **LOW RPM**

Glide distance is approximately 2 nm per 1000 feet of altitude above the terrain, however this may vary significantly. It is suggested that it be established for your individual aircraft.

LANDING EMERGENCIES

Landing without power

When landing site is selected and committed to landing the following checklist can be completed. The use of gear UP versus gear DOWN is a function of the landing site. If the landing is to be made on water, a foamed runway or the sod adjacent to a runway, the gear would generally be best left up. If the terrain is harsh the gear may well absorb energy and although resulting in substantial damage to the aircraft may in that process afford some protection to the occupants and thereby be the preferable option. When assured of reaching the landing area;

Seat Belts/Shldr Harness..... **TIGHT**
 Canopy **LATCHED**
 Gear..... **UP or DOWN**
 Fuel Pump..... **OFF**
 Mixture **CUT-OFF**
 Mags **OFF**
 Flaps..... **AS REQUIRED**

Master **OFF**
 Airspeed **DECREASE** to Touch Down

Attempt to fly the aircraft and keep the wings level through the approach **and landing** until the aircraft comes to rest. **EXIT THE AIRCRAFT** and remain clear until assured there is no possibility of fire.

SYSTEMS EMERGENCIES

PROPELLER OVERSPEED

The controllable pitch Hartzell propellers (with Woodward or McCauley governors) used on the Legacy utilize oil pressure from the governor to increase pitch (low rpm), others may operate in an opposite manner. Therefore it is the responsibility of the pilot to know his aircraft and its system specifically.

It is however dangerous to run any engine over its rated rpm and thus the method to reduce any overspeed is to **immediately reduce the throttle to idle** and reduce airspeed to the point where rpm control is regained. Slowly add throttle and hold airspeed well below that at which the overspeed occurred. Mixture may need to be adjusted also for smooth operation. If the overspeed was significant, i.e. over 200 rpm over redline, an engine inspection is called for upon landing. Engine operation for the balance of the flight must be monitored closely.

PROPELLER DAMAGE

As with any major component of an aircraft, the propeller demands proper care. Nicks, scratches and other types of damage require care. While the construction varies, all are highly stressed and these nicks cause stress concentrations to a greater or lesser degree which are dangerous. Refer to the manual for your propeller for proper limits of damage, the proper “care and feeding” of your propeller. Preflight your aircraft accordingly. The loss of any significant portion of a blade can be catastrophic.

ELECTRICAL SYSTEM FAILURE

The electrical system of your aircraft is key to safe operation in today’s environment. It is required for night or IFR operations. If a voltmeter is installed it will be your key indicator of alternator failure which then places the entire electrical load on the battery. For 14 volt systems, the battery will read approximately 12.4 volts on a full battery, and 14+ on the alternator. For 28 volt systems, the battery will read approximately 24.2 volts on a full battery, and 28 volts on the alternator. If you

experience alternator failure;

Master Switch	OFF
Avionics Master	OFF
Lights	OFF
Circuit Breakers	CHECK

A check of the circuit breakers may reveal a popped breaker indicating the source of the trouble. If so, turn all individual equipment OFF, reset the breaker and turn the Master Switch ON. If the breaker does not activate again, slowly turn various elements of your system ON one at a time watching for another malfunction attempting to isolate the problem.

If you believe the problem has been isolated and you elect to continue the flight, remain alert for another anomaly caused by the first difficulty.

NOTE

Each aircraft electrical system varies. Your aircraft may be equipped with back up batteries and/or alternators. Know your electrical system and adapt your emergency procedures accordingly

SPEED BRAKES

The Precise Flight speed brakes are designed such that it is impossible for one to deploy and remain fully deployed while the other is down. If you experience problems with the speed brakes, pulling the circuit breaker will collapse the speed brakes. **Do not use the speed brakes in icing conditions as they may not retract.**

If all attempts to retract them fail, land using 110 KIAS on final. Flight testing has shown that the Legacy has sufficient roll control to land with one extended and the other retracted.

BE AWARE OF INCREASED SINK RATES

LANDING GEAR

Your Lancair gear is held up by hydraulic pressure. Pressure switches shut off the electrical power to the pump in both the up and the down positions. If the gear will not remain retracted it may be discernable by loss of cruise speed and/or additional wind noise. Proper actions are:

Airspeed, reduce to	90 KIAS
Gear Circuit Breaker	PULL
Gear Switch	DOWN
Gear Dump Valve	OPEN
Gear.....	3-LIGHTS
Gear Dump Value	CLOSED

It may be necessary to slip the aircraft allowing airloads to help push gear to full down. An observer (tower or aircraft) can be used to confirm its full down position.

WARNING

Aircraft observers must be used with caution as not all pilots have the training to safely fly “formation” and may not be sufficiently familiar with the Lancair gear to confirm its down and locked configuration.

Once lowered it is not advisable to attempt a retraction prior to landing and determining the cause of its failure to remain fully up.

UNLATCHED CANOPY IN FLIGHT

The Canopy must not be opened in flight. Doing so may cause it to separate from the aircraft possibly injuring the occupants in the process.

Should a latch become disengaged from the locked position, slow the aircraft to approximately 85 kts and attempt to relock. If unable to lock, land as soon as practical.

SPINS

Spins are not recommended. If a spin is entered inadvertently or intentionally the stick should be neutralized or placed forward, the rudder full against the direction of the spin until rotation is stopped. At this point, the maneuver should be flown out of with smooth, positive load factor pull-out of no more than 4.5 g's taking particular care not to reenter an accelerated stall and another spin.

WARNING

The Legacy is aerodynamically very clean and thus can lose a lot of altitude with such maneuvers.

EMERGENCY SPEED REDUCTION

In an emergency, the landing gear can be used to assist in reducing the speed of the aircraft quickly. Gear extension should be accompanied by idle power.

A thorough gear inspection is required following such an emergency extension and the gear should never be retracted prior to this inspection.



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NOTES:

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NORMAL PROCEDURES

SECTION IV

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SAFE OPERATING AIRSPEEDS

NOTE

All airspeeds in this section are indicated airspeeds (IAS) and assume zero instrument error. You should make sure your system has been correctly calibrated and account for those errors as necessary .

NOTE

Best airspeeds will vary based on individual aircraft.

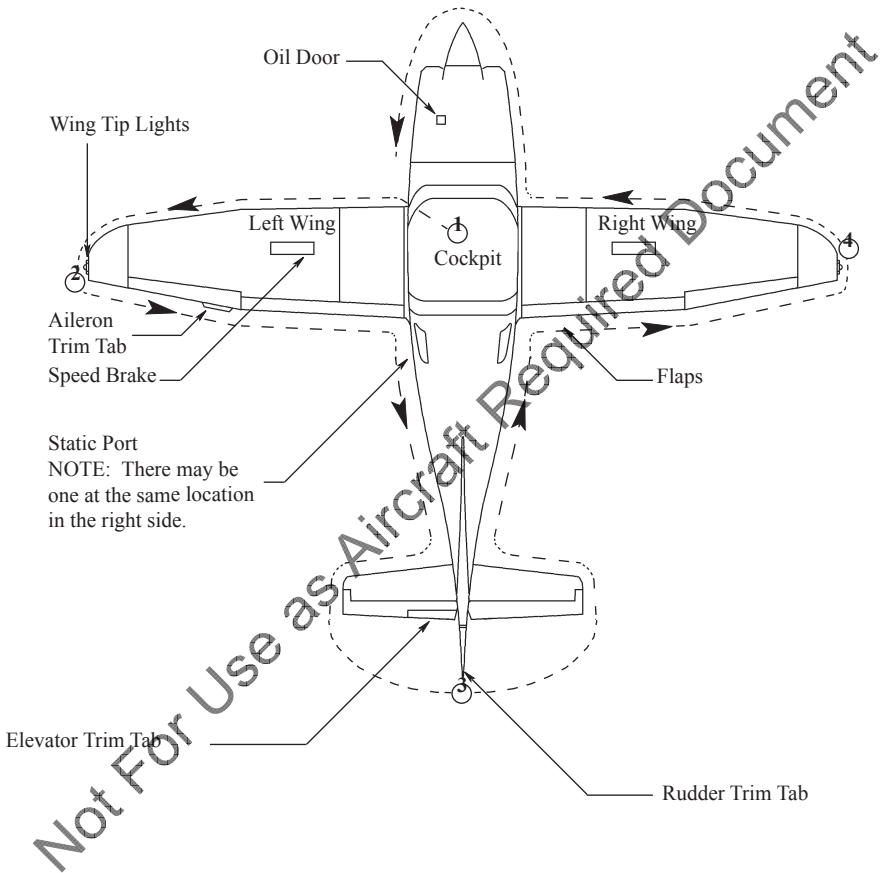
Max Demonstrated X-WIND Component - 25 KIAS

Take-off Speeds

Rotation.....	60 KIAS
Best Angle of Climb - V_x	102 KIAS
Best Rate of Climb - V_y	135 KIAS
Cruise Climb -	145 KIAS
Landing Approach	
Flaps DOWN -	95 KIAS
Flaps UP -	105 KIAS

NOTE

Best angle and best rate speeds are for gear up and flaps up.



PREFLIGHT INSPECTION

1. Cockpit

1. Control LockREMOVE
2. Ignition SwitchOFF
3. Gear SwitchDOWN
4. Master Switch.....ON
5. Gear Position Lights3 GREEN
6. Fuel Quantity IndicatorsCHECK QUANTITY.
7. Fuel Selector Valve.....FULLEST TANK
8. FlapsDOWN
9. Lights.....CHECK for night operations
10. Master Switch.....OFF
11. Canopy Seal.....CHECK CONDITION

2. Left Wing

1. Main Gear and TireCHECK for proper inflation and general condition. Visually inspect oleo strut for leaks. Visually inspect the over centerlinkage and the hydraulics. Look for leaks. Inspect the set screw of the sequence valve
2. Brake PadsCHECK condition
3. Brake Line.....CHECK condition
4. Gear DoorsCHECK condition. There should be no cracks. Carefully inspect the inboard gear door hinge for cracks.
5. Pitot TubeREMOVE cover, check for obstructions.
6. Fuel Drain.....DRAIN as necessary. (NOTE: Two drains per wing).
7. Wing Tie DownDISCONNECT
8. Fuel QuantityCHECK visually for desired level.
9. Fuel Filler Cap.....SECURE
10. Speed BrakesCHECK condition
11. Wing Tip Lights.....CHECK for damage
12. Wing Tip Vent.....CHECK clear

13. Wing Tip.....INSPECT for cracked paint and general damage.
14. Left Wing.....SIGHT down along the upper surface, leading edge and lower surface. It should be smooth with no buckling or distortion.
15. Left AileronCHECK motion. The aileron should move smoothly and freely.

WARNING

The ailerons and flaps must not interfere. Inspect the inboard surface of ailerons and outboard surface of flaps for signs of wear.

16. Aileron Trim TabThe hinge pin must be safety wired. Inspect the actuator arm (verify cotter pin in installed). There must be no play in trim tab.
17. Left FlapCHECK for movement and security. CHECK that hinge pins, have circlip properly install and the safety wire.

3. Empennage

1. Static PortCHECK for blockage
2. Tail Tie Down.....DISCONNECT
3. Control Surfaces.....CHECK freedom of movement and security. No rubbing!
4. Trim Tabs.....The hinge pins must be secure. Verify the cotter pins of the trim tab actuator arms are secure. There must be no play in the trim tab.
5. Tail Surfaces.....STRAIGHT with no damage.
6. Rudder CablesNO bending of cable to fitting.
7. Rudder Pushrod Connection.....Inspect visible portion.

4. Right Wing

1. Right FlapCHECK for movement and security. CHECK that hinge pins, have circlip properly installed and check the safety wire.

2. Right AileronCHECK motion. The aileron should move smoothly and freely.

WARNING

The ailerons and flaps must not interfere. Inspect the inboard surface of ailerons and outboard surface of flaps for signs of wear.

3. Right WingSIGHT down along the upper surface, leading edge and lower surface. It should be smooth with no buckling or distortion.
4. Wing TipINSPECT for cracked paint and general damage.
5. Wing Tip Vent.....CHECK clear
6. Wing Tip Lights.....CHECK for damage
7. Speed BrakesCHECK condition
8. Fuel Filler Cap.....SECURE
9. Fuel QuantityCHECK visually for desired level.
10. Wing Tie DownDISCONNECT
11. Fuel Drain.....DRAIN as necessary. (NOTE: Two drains per wing).
12. Gear DoorsCHECK condition. There should be no cracks. Carefully inspect the inboard gear door hinge for cracks.
13. Brake Line.....CHECK condition
14. Brake Pads.....CHECK condition
15. Main Gear and TireCHECK for proper inflation and general condition. Visually inspect oleo strut for leaks. Visually inspect the over center linkage and the hydraulics. Look for leaks. Inspect the set screw of the sequence valve
16. Landing and Taxi LightCHECK condition

5. Nose Area

1. Gascolator.....DRAIN as necessary.
2. TireCHECK for proper inflation and general condition. Visually inspect the oleo strut for leaks. Inspect over

- center linkage. Inspect hydraulics and look for leaks.
3. Gear DoorsCHECK condition. Make sure they move freely.
 4. CowlingCHECK secure. Check that all cowl- ing screws are installed.
 5. Cooling IntakesNO obstructions, birds nests, etc. Inspect baffle seals with flash light

WARNING

Always assume the propeller is “HOT” and the engine ready to start when handling the propeller regardless of mag switch position.

6. PropellerCHECK condition

CAUTION

See propeller manufacturer's instructions for nick and damage treatments and limitation. Damaged propellers are dangerous - failures can be catastrophic.

7. SpinnerCHECK condition. Must be secure. No cracks at attach screws.
8. Oil QuantityCHECK level.
9. Dip StickSECURE
10. Inspection DoorCLOSE/SECURE

BEFORE STARTING - (Checklist)

1. BaggageStowed, loose items SECURED
2. Rudder PedalsADJUSTED
3. Seat Belts/Shoulder HarnessADJUSTED & SECURE
4. BrakesCHECK and HOLD
5. Circuit BreakersCHECKED and IN
6. Master SwitchOFF
7. Avionics Master SwitchOFF
8. Avionics SwitchesOFF
9. Gear SwitchDOWN
10. CanopyLATCHED

STARTING - (Checklist)

1. Master Switch.....ON
2. Fuel QuantityCHECK, compare with visual check
3. Carb Heat/ Alternate Air.....OFF
4. MixtureRICH
5. ThrottleOPEN 1/4 INCH
6. PropellerIN (MAX RPM)
7. Boost PumpCHECK OPERATION
8. PrimeAS REQUIRED
9. Clear Propeller.....CALL "CLEAR"
10. Magneto.....BOTH (AT CRANKING SPEED)
11. StarterENGAGE
12. ThrottleADJUST TO 1000 RPM
13. Oil PressureCHECK (within 30 sec or shutdown)
14. Alternator.....ON
15. Radios/Avionics.....ON (as required)
16. MixtureLEAN (during taxi to help avoid plug fouling)

COLD STARTING

Cold starts are similar to normal starts except that more fuel may be required. For temperatures below 0°F preheating of the engine may be desirable as well as use of a warm battery. Care must be used to limit operation of the starter motor to 30 seconds for each 4 minutes of time to allow internal windings to cool. Also oil pressure will take longer than normal to indicate.

FLOODED ENGINE - (Checklist)

1. MixtureCUT-OFF
2. PropellerHIGH RPM
3. Throttle1/2 OPEN
4. MagsBOTH
5. StarterENGAGE
6. Upon start, ThrottleIDLE (≈1000 RPM)
7. MixtureRICH

HOT STARTING

Starting a hot engine can be difficult. This is particularly true with fuel injected engines and is generally due to vapor lock in the fuel system. All engines vary in their starting characteristics within the same models due in part to technique. Installation effects, fuel, battery condition etc. can all play a part. Cold engines will have one starting characteristic, another when hot after 10 or 15 minutes, and perhaps another after 30 minutes or so. Some experimentation and taking notes as to the technique that works, as well as advice from others who operate the same model engine can be helpful.

NOTE

Be sure to allow adequate cooling periods between starting attempts and avoid long continuous periods of cranking as damage to the starter will result.

NOTE

In some cases with the Lycoming, the flooded engine procedure may work well for starting a hot engine.

WARNING

Should a backfire occur during any start, continue cranking to draw any fire back into the engine. If backfiring continues or an engine compartment fire starts, shut down and EXIT the aircraft. Use fire extinguisher to extinguish any fire.

GROUND WARM-UP

Teledyne-Continental, and Textron Lycoming aircraft engines are air-cooled and are dependent on the forward speed of the aircraft for cooling. To prevent overheating, it is important that the following rules be observed:

1. Head the aircraft into the wind.
2. Operate the engine on the ground with the propeller in "Full Increase" RPM position.
3. Avoid prolonged idling at low RPM. Fouled spark plugs can result from this practice.

4. Warm up 900 - 1000 RPM.
5. Oil Door - Closed.

PRE-TAXI CHECKS - (Checklist)

1. Prior to power application.....CLEAR area around and aft
2. Brakes.....CHECK

PRE TAKE-OFF RUN-UP - (Checklist)

1. CanopyLOCKED
2. AreaCLEAR
3. Brakes.....SET
4. CHT /Oil Temp.....GREEN
5. Throttle1800 RPM
6. Propeller (controllable)CYCLE TWICE
7. Mags.....CHECK
 Lycoming: (Max 175 rpm drop, 50 rpm difference)
 Continental: (Max 150 rpm drop, 50 rpm difference)
8. ThrottleIDLE, then 1000 rpm
9. Suction.....CHECK (4.8 - 5.2 in. Hg.)

BEFORE TAKE-OFF - (Checklist)

1. CanopyLOCKED (recheck)
2. Seat Belts/Harness.....SECURE
3. Instruments *CHECK
4. Fuel Quantity.....CHECK
5. Oil Press/TempCHECK, GREEN
6. Breakers.....IN
7. Master Switch.....ON
8. Avionics Master.....ON
9. Radios.....ON & SET
10. Auto Pilot.....OFF
11. TransponderTO STANDBY
12. PropellerFULL IN (Max RPM)
13. MixtureFULL RICH
14. Boost PumpAs Desired
15. Trims.....SET
16. Flaps SetSET (-10°)

17. Controls Free.....CHECK
18. Door Seal.....ON

*** NOTE**

**Allow enough time for the gyro instruments to fully erect.
A minimum of five (5) minutes is recommended, eight (8) minutes if IMC conditions exist.**

RUNWAY CHECKS - (Checklist)

1. Strobes.....ON
2. Transponder.....ALT
3. Approach and T.O. Area.....CLEAR
4. Boost.....AS REQUIRED
5. Clearance from Tower.....RECEIVED AND
.....ACKNOWLEDGED
6. Takeoff Runway.....CLEAR
7. Time Off.....NOTE

TAKE-OFF & CLIMB - (Checklist)

1. Take-off Power.....2700 RPM
2. Oil Temperature.....100°F MINIMUM
3. Cylinder Head Temperatures.....150°F MINIMUM
4. After Power Application.....CHECK Engine Instruments
5. Check Flight Instruments.....OPERATING
6. Rotate.....65 - 75 KTS
7. Initial Climb to 1000'.....120 KTS
8. Positive Climb.....GEAR UP
9. Alt >800 feet AGL.....FLAPS UP
10. Reduce RPM.....2500 RPM
11. Mixture.....LEAN FOR CLIMB*
12. Cylinder Head Temps.....500°F MAXIMUM
13. Oil Temperature.....240°F MAXIMUM

NOTE

These numbers are typical. Check for your specific engine and aircraft.

14. Climb Speed(V_x) 102 KIAS until all obstacles are cleared
 (V_y) 135 KIAS Best Rate of Climb
 140 KIAS and greater Normal Climb

CRUISE - (Checklist)

1. ThrottleAS DESIRED SET
2. Ram Air (if installed).....OPEN
3. Propeller2400 RPM SET
4. MixtureLEAN AS REQ'D*
5. Low Boost above 10,000'ON

GENERAL LEANING RULES

NOTE

The following are excerpts from the Lycoming Engine Operating Handbook and should be generally applicable for all engines.

- A. Never exceed the maximum cylinder head temperature limits.
- B. For maximum service life, CHTs should be maintained below 435°F (224°C) during high performance cruise operations and below 400°F (205°C) for economy cruise powers.
- C. Maintain "Full Rich" for Take-off, and climb. For take-off from high altitude airports, if engine roughness is noted, lean only enough to obtain smooth operation. Be alert for temperature rise. This is most likely to occur at altitudes over 5000 feet. Consult engine manufacturer's recommendations for cruise leaning procedures.
- D. Always return to full rich before increasing power settings.
- E. Operate the engine at maximum power mixture for performance cruise powers and at best economy mixture for economy cruise power .
- F. During let-down flight operations it may be necessary to manually enrichen uncompensated carbureted or fuel injected engines to obtain smooth operation.

- G. On turbocharged engines never exceed 1650°F turbine inlet temperature (TIT) with standard turbochargers.
- H. Changes to cruise altitudes and/or power settings require the mixture to be reset.

NOTE

The following guidelines reflect recommended procedures with the specified equipment. It is prudent to know each method in case of equipment failure.

LEANING, EXHAUST GAS TEMPERATURE

Continental:

Lean to 50°F Rich or lean of the peak EGT.

Lycoming:

Lean to 50°F Rich of peak EGT.

LEANING FLOWMETER

Lean to the applicable fuel-flow tables or lean to an indication marked for correct fuel flow for each power setting.

LEANING, MANUAL MIXTURE CONTROL

Carbureted Engines

1. Slowly move mixture control from “Full Rich” position towards lean position.
2. Lean until engine roughness is observed.
3. Enrich until engine runs smoothly and power is regained.

Fuel Injected Engines

1. Slowly move mixture control from “Full Rich” towards lean position
2. Continue leaning until slight loss of power is noted (this may or may not be accompanied by roughness)
3. Enrich until engine runs smoothly and power is regained

USE OF CARBURETOR HEAT/ALTERNATE AIR

NOTE

This section on carburetor icing obviously does not apply to fuel injected engines normally installed on the Lancair Legacy. Follow normal procedures for carburetor icing.

ADDITIONAL CHECKLISTS

The use of written checklists is the safest means of insuring that all items in a sequence are covered and acted on correctly. Their use is a sign of maturity and professionalism. Those provided herein for the Lancairs are for your convenience. Modifications may be required for your particular aircraft.

DESCENT - (Checklist)

1. Fuel Selector.....AS DESIRED
2. Fuel PumpOFF
3. Altimeter.....SET (FOR BARO OR FIELD ELEVATION)
4. Mixture.....ENRICHEN THRU DESCENT OR FULL RICH
5. Power.....AS REQ'D (Use caution, avoid rapid and excessive cooling)
6. CHTs.....MAINTAIN greater than 180°F
7. Ram Air (if equipped)CLOSED

PRE-LANDING - (Checklist)

1. Seat Belts/Shoulder HarnessFASTENED
2. Fuel Selector.....AS DESIRED
3. Mixture.....RICH
4. Landing Gear.....DOWN (140 KTS MAX), 3-GREEN
5. FlapsFULL (120 KTS)
6. PropellerHIGH RPM
7. Brakes.....CHECK and PUMP
8. EstablishNORMAL APPROACH

BALKED LANDING - (Checklist)

1. ThrottleFULL
2. Airspeed.....95 KTS, ESTABLISH CLIMB
3. FlapsRETRACT TO 20°
4. GearRETRACT

AFTER LANDING - (Checklist)

(After turning off runway)

1. FlapsUP
2. Strobes.....OFF
3. Transponder.....STANDBY
4. Lights.....AS REQUIRED
5. TrimRESET FOR TAKE-OFF
6. Canopy Seal.....OFF
7. Time.....NOTE

SHUTDOWN - (Checklist)

(At parking site)

1. Radios.....OFF
2. Avionics Master.....OFF
3. Throttle.....IDLE
4. Mixture.....IDLE CUT-OFF
5. Mags (After engine stops).....OFF
6. Lights.....OFF
7. Master Switch.....OFF
8. Chocks/Tiedown.....SECURE

ABBREVIATED TAKE-OFF CHECKLIST - (C.I.G.A.R.T.I.P.)

ControlsFREE AND CORRECT

Instruments

- Gear Switch.....DOWN
- Circuit BreakersIN
- AltimeterSET
- Directional GyroSET

Radios	SET
Engine Instruments	IN GREEN
Gas	
Shut Off	OPEN
Boost	AS DESIRED
Fuel Pressure	CHECK
Mixture	RICH
Attitude	
Flaps	10°
Trim	SET
Autopilot	OFF
Run-up	
Brakes	SET
Nose wheel	Straight
Mag Check:	
Lycoming:	1800 RPM, 175 max each, 50 rpm difference
Continental:	1800 RPM, 150 max each, 50 rpm difference
Propeller	2 CYCLES
Oil Pressure	IN GREEN
Trim	
Aileron trim	Neutral
Rudder trim	Set for takeoff
Elevator trim	Set for takeoff
Interior	
Seat belts	FASTENED
Canopy	LATCHED
Propeller	FULL RPM
Autopilot	OFF
Speedbrakes	RETRACTED

ABBREVIATED LANDING CHECKLIST (G.U.M.P.)

Gas

Fuel Tanks **SET FULLEST TANK**
 Boost **AS DESIRED**
 Fuel Pressure **CHECK**

Under Carriage

Gear **DOWN, 3-GREEN (140 kts max)**
 Flaps **SET**

Mixture

Mixture Control **RICH**

Prop

Propeller Control **HIGH RPM (In)**

HEATING & VENTILATION

Cooling air. Your Lancair is equipped with simple air intake scoops for cabin ventilation. The vents are located at the pilot's left knee and co-pilot's right knee.

Heating. Cabin heat is provided by means of an intake system using air warmed by passing over/thru a heat exchanger where exhaust gases are used as the heat source. This air-to-air heat exchanger provides air which is either dumped overboard, or into the cabin. Due to the potential of a leak from the higher pressure exhaust gases containing Carbon Monoxide (CO) into the fresh air side of this heat exchanger, it is necessary to inspect the structural integrity of the unit periodically. Initial operation of the system for the winter months should always include such an inspection. A monitoring system should be considered for the cabin air. These simple devices change color upon exposure to CO. They are quite cheap, and excellent insurance against the effects of this odorless, colorless, and deadly gas. Optionally install an electric CO monitor available through Lancair Avionics.

COLD WEATHER OPERATIONS

PREFLIGHT INSPECTIONS

Winter preflight inspections of the aircraft need to account for the accumulation of frost or ice on the exterior of the aircraft. The Lancairs with their extraordinary smoothness can suffer markedly from the effects of such accumulations as they utilize laminar flow airfoils. These effects result in significantly higher drag of the air-frame and wings as well as reduced lift and increased weight of the accumulation. Once these deposits have been removed (preferably by warming in a hangar) the preflight should include special emphasis on freedom of control movements.

ENGINE CONSIDERATIONS

Very cold temperatures require extra considerations for engine starting and operations. The engine oil will be significantly more viscous resulting in higher oil pressures, slower indication upon starting, increased engine wear, tappet noise (if equipped with hydraulic lifters) poor battery performance, etc.

During extreme cold weather it may be necessary to preheat the engine oil and battery before starting. Since the engines are cooled by pressurized air created in flight, ground operations must be minimized at high ambient temperatures and conducted with care at all times.

Engine operations should be into the wind when possible. The mixture should be RICH. Avoid prolonged idling and do not exceed 2200 rpm on the ground. Warm up should be at 1000-1200 rpm.

The engine is warm enough for take-off when the throttle can be opened without faltering. Take-off with a turbocharged engine should not be started if indicated lubricating oil pressure, due to cold temperatures is above maximum. Excessive oil pressure can cause overboost and consequent engine damage.

CRUISE OPERATION

Cold weather cruise operation may require an occasional cycle of the propeller control. This could be particularly true after long duration cruise just prior to descent where lack of governor control could cause overspeeding. During descents and landing, give special attention to cylinder head temperatures, since the engine will easily over cool.

ICING CONDITIONS

Flight in icing conditions is prohibited.

Should ice be inadvertently encountered it can be expected that drag will increase, possibly markedly, stall speeds will increase, again possibly significantly, and extreme care must be exercised while ice is present on the airframe. It is prudent to avoid icing conditions if at all possible.

NOISE

All approaches and departures should be made with noise considerations second only to safety. More and more areas are becoming noise sensitive and our consideration of such areas will prolong our ability to operate in a friendly community environment. It is preferable to avoid rather than overfly such areas. Where necessary to overfly, do so at reduced power if prudent and overfly at 2000 feet AGL or higher.

NOTE

The above suggestions are recommended where they do not conflict with weather conditions, ATC clearances or instructions, or where in the judgment of the pilot, they can be complied with safely.

No flyover noise level has been established for these Lancair aircraft, as defined by FAR 36 requirements, nor has the FAA determined that the noise level of these airplanes is considered acceptable or unacceptable for operations into or out of any airport.



NOTES:

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PERFORMANCE

SECTION V

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INTRODUCTION TO PERFORMANCE

The graphs and tables presented in this section identify performance information for aid in flight planning at various parameters of aircraft weight, engine powers, altitudes and temperatures. Data you obtain will be peculiar to your aircraft since its construction and measurements differ from all others. The values (data) you generate and put into the blank charts provided should be conservative and will represent the way you fly your aircraft. In most cases it is suggested that you gather the data, plot it on a copy of the chart and when satisfied plot the final data in your manual.

NOTE

All airspeeds in this section are indicated airspeeds in knots (IAS) and assume zero instrument error. Make sure your system has been correctly calibrated and account for those errors as necessary .

Due to the Lancairs' high cruise speed, the location and quality of the static source can be critical to the systems accuracy. Most importantly indicated altitude is affected. This in turn affects calibrated airspeed, i.e. indicated airspeed corrected for errors due to both the location of the pitot and static port/s on the aircraft.

ALTIMETER CORRECTIONS

Static source errors result in **altimeter** errors **and indicated airspeed** errors. An airspeed indicator is essentially a differential pressure gauge (pitot vs static) marked with mph or knot indications. The aircraft static source is used to transmit encoded altitude and thus must be accurate when used for IFR operations.

Static source correction data should be obtained first, then the corrected altitudes flown for the airspeed system calibrated tests. Prior to calibration of the system it is best to have your altimeter (the panel gauge) calibrated. This provides a correction curve from indicated to true altitude which should be taken into account when obtaining calibrated values.

Static system calibrations are typically accomplished utilizing "Tower passes", a known aircraft, the "pacer" method, or a "trailing cone".

Tower Pass Calibrations

“Tower passes” require numerous fly-bys, each gathering a data point at a specific flight speed and configuration. The aircraft is flown past a tower where pressure altitude in the tower, aircraft indicated altitude, aircraft distance to the tower and aircraft height above/below the tower are recorded. For example the aircraft must be flown (at least two wing spans above the ground to eliminate ground effects) along a centerline (runway or taxiway) which is a known distance from the tower. The indicated altitude of the aircraft is recorded for each level pass when the aircraft is normal (off the wing tip) to the tower and photographed from the tower using a camera (a polaroid works great). The aircraft’s height above or below the tower altimeter is later determined for each data point by scaling the length of the aircraft in the picture and its distance above/below the horizon and knowing the distance from the tower camera (at the same altitude as the tower altimeter/s) to the centerline. Even the estimated distance off the centerline for each pass should be recorded to correct the tower to aircraft distance. Thus a correction of aircraft indicated altitude versus true (tower) altitude can be determined.

Extreme care should be used when flying such passes particularly the low speed and “dirty” passes. The minimum recommended fly-by speed is 80 kts, and cool smooth early morning air is best for calm air and traffic reasons. The data should be plotted and a smooth curve faired to extrapolate data to the lower speeds. A cooperative tower is required as well as a “helper” in the tower to record data and obtain the photos.

Pacer Calibrations

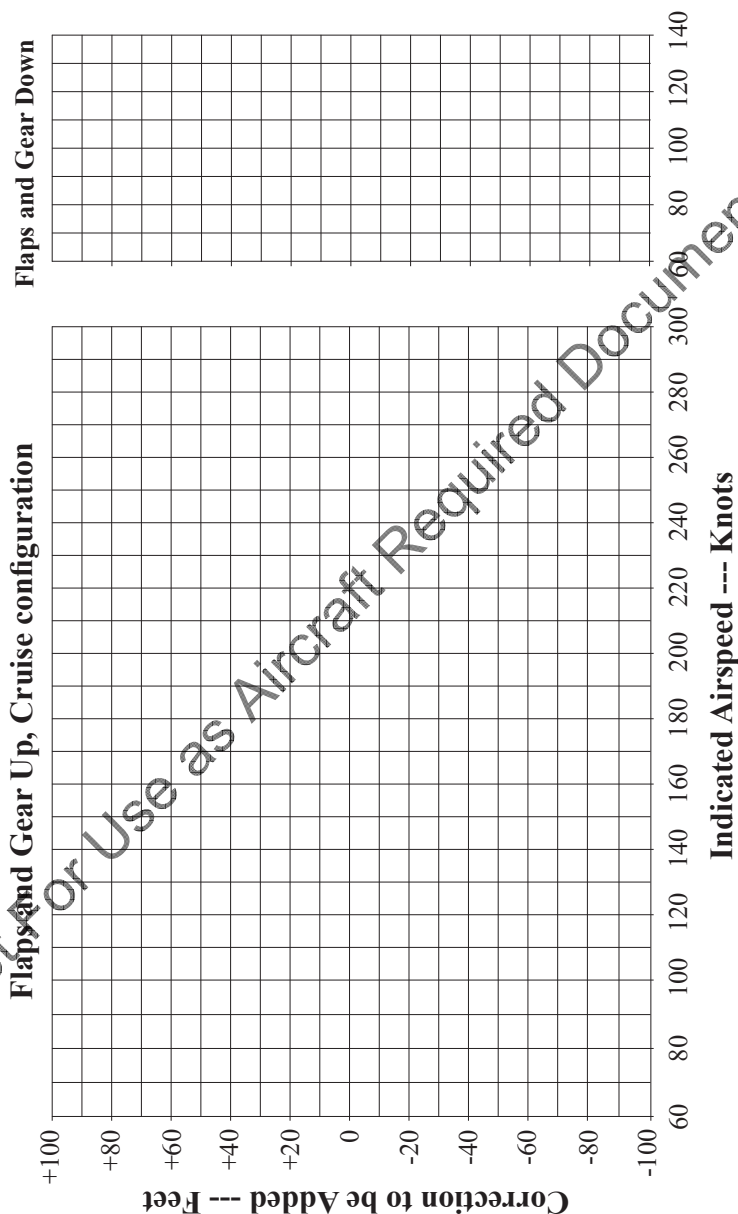
Pacer rests consist of flying side-by-side with another aircraft with a “known” static recording both aircraft’s speeds and altitudes at various test aircraft configurations of gear and flaps settings, and across the applicable speed range. Corrections to the test aircraft’s altitude and airspeed can be determined based on the pacers corrected speed and altitude as shown in its Pilots Operating Handbook. Obviously both aircraft should be at the same altitude and speed for each data point and the closer the two are the more accurately any altitude differences can be detected. A minimum of four wingspans of the larger of the two planes should be maintained to eliminate the potential of one aircraft’s pressure field effecting the others sensing system. Again extreme care is required as formation flying is inherently nonforgiving for inexperienced and/or non practiced pilots.

Trailing Cone Calibrations

Another method utilizing a “trailing cone” can be utilized for “solo” data gathering which will eliminate the hazards and transfer errors of a pacer calibration and the time consumed by tower passes as well as increase the measurement accuracy. This data can be gathered at several altitudes, across the full speed range, with far greater accuracy, and require no external assistance. This requires the use of a drag cone which is trailed behind the aircraft (typically from the top of the vertical fin) and at such a length that the pressure field of the aircraft has decayed. (This is on the order of 35 feet for the Lancair.) Static ports are located in the tubing forward of the cone 10 to 12 cone diameters. Since the “Cone” provides true outside pressure altitude, a differential pressure gauge between the Cone and the aircraft’s system will display the error. This eliminates the error associated with the comparison of two absolute measurements but requires the use of tables of pressures versus altitudes in the range of inches of water for the altitudes flown. The result is however an extremely accurate calibration of your static source such that you will know that your corrected 8000 feet in IMC conditions is really 8000 feet, and you’ll know the effects of gear and flaps on indicated altitude also. The Trailing Cone is used world wide for static source location development and certification purposes.

Once these data are gathered by whichever means, they can be plotted on the following chart and then represent the calibration for your aircraft specifically. These corrected altitudes should then be flown for all subsequent airspeed system tests.

ALTIMETER CORRECTION - (Owners Calibration)



Altimeter Correction Chart

AIRSPPEED SYSTEM CALIBRATION

Airspeed pitot and static system calibrations can be obtained while flying against the pacer aircraft. Pitot systems can also be calibrated by flying between two known locations (fixes), in opposite directions carefully measuring the time and air temperature then working back from true airspeed to a calibrated value. (The altimeter system should be calibrated prior to this test.) Ideally the wind should be calm, along the flight path, and the test run at relatively low altitude to minimize the timing errors due to fix passage factors. LORAN, DME, and GPS can all be used effectively when the DME station slant range is minimal. A test leg from 50 to 75 miles from the station and return would be acceptable.

This calibration data can be plotted as lines (faired thru the data scatter) on the accompanying charts and tagged as to flap position (up, approach and full, typically) and gear position, or presented in tabular form for each configuration. The data should be taken from the lowest practical speed to maximum in approximately 20 knot increments. If the chart method is used, it would be prudent to plot the data, fair a smooth line thru that data, then plot the faired line data to reduce data acquisition scatter. Thus data obtained at 154 kts for example could be "corrected" and tabulated at 150 or 160 kts.

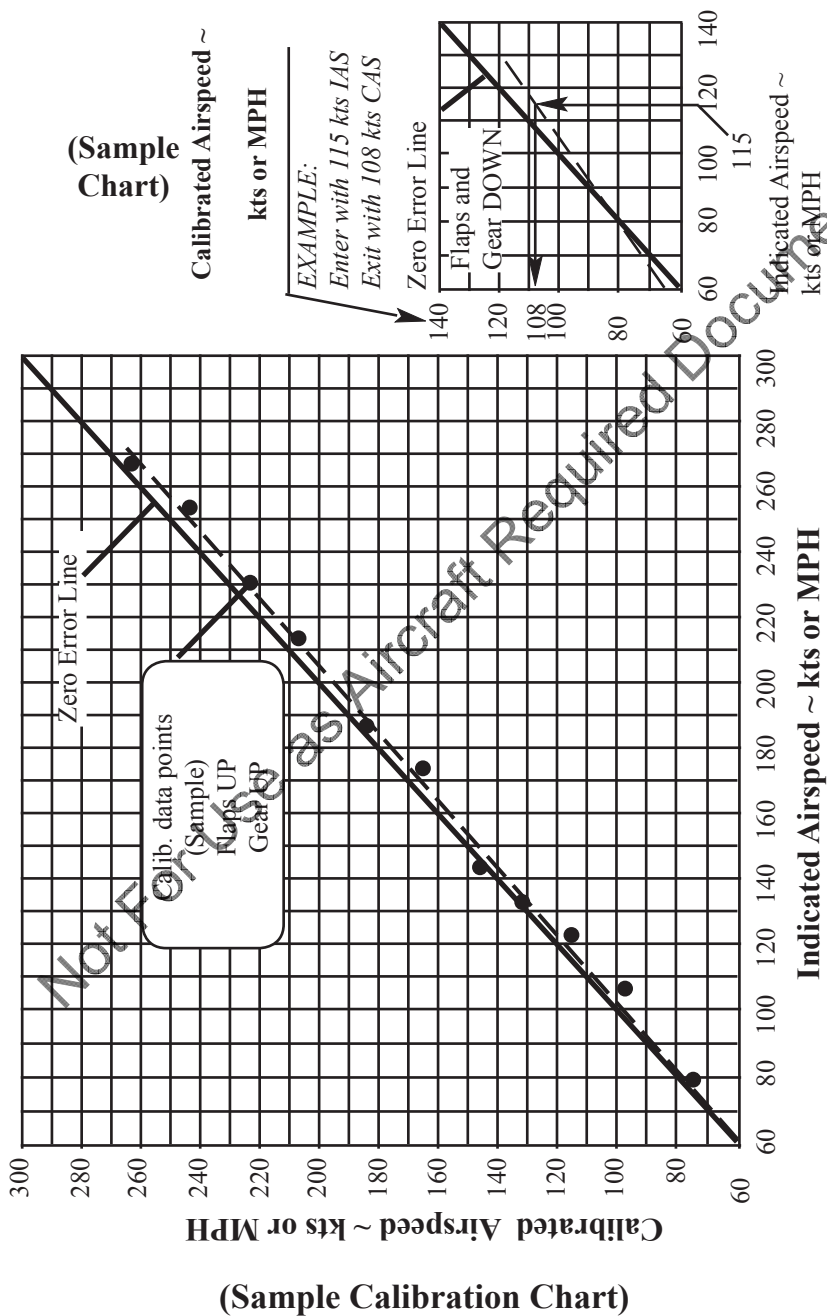
A sample chart is shown as well as a blank suitable for your use. It is suggested that you initially plot your data on the sample chart and when satisfied with that transfer it to your own blank.

Example Data

Cruise Configuration			Landing Configuration		
Actual IAS KTS/MPH	Add	Calibrated CAS KTS/MPH	Actual IAS KTS/MPH	Add	Calibrated CAS KTS/MPH
80	+5	85	70	-5	65
90	+5	95	80	-5	75
100	+4	104	90	-4	86
110	+2	112	100	-2	98
120	0	120	110	0	110
130	-1	129	120	+3	123
etc.		etc.	etc.		etc.

Airspeed Calibration Data Samples

Airspeed Calibration



Airspeed
Calibration

for _____

Calibrated Airspeed ~

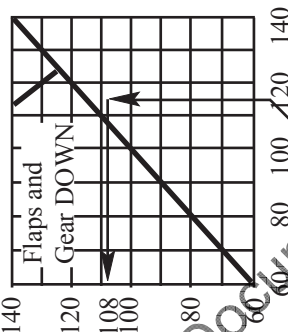
kts or MPH

EXAMPLE:

Enter with 115 kts IAS

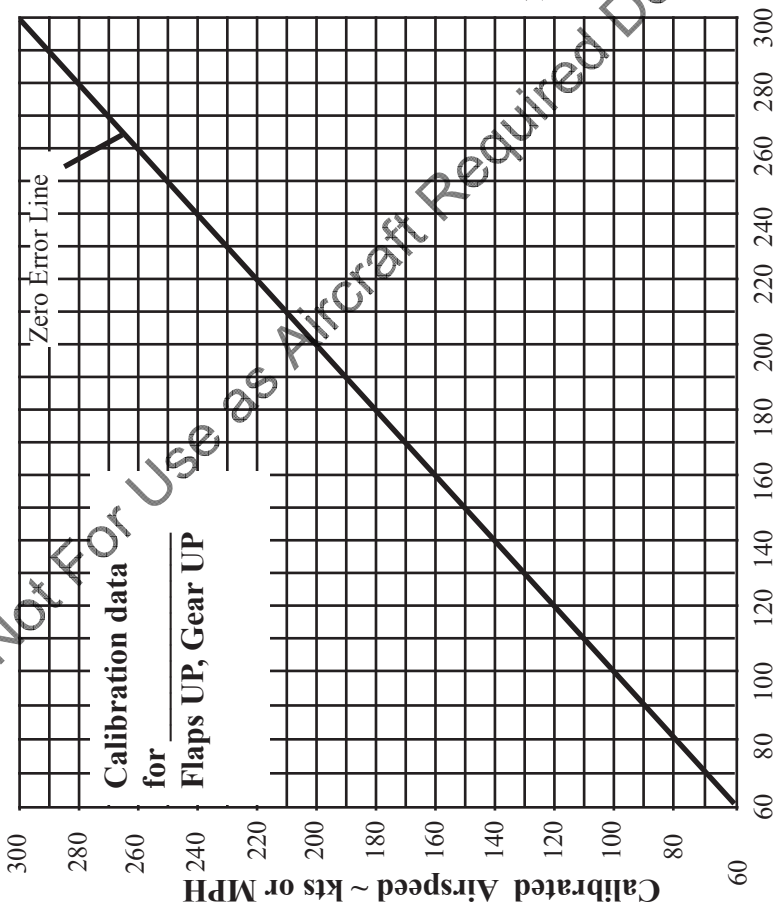
Exit with 108 kts CAS

Zero Error Line



Indicated Airspeed ~

kts or MPH



Airspeed Calibration for _____

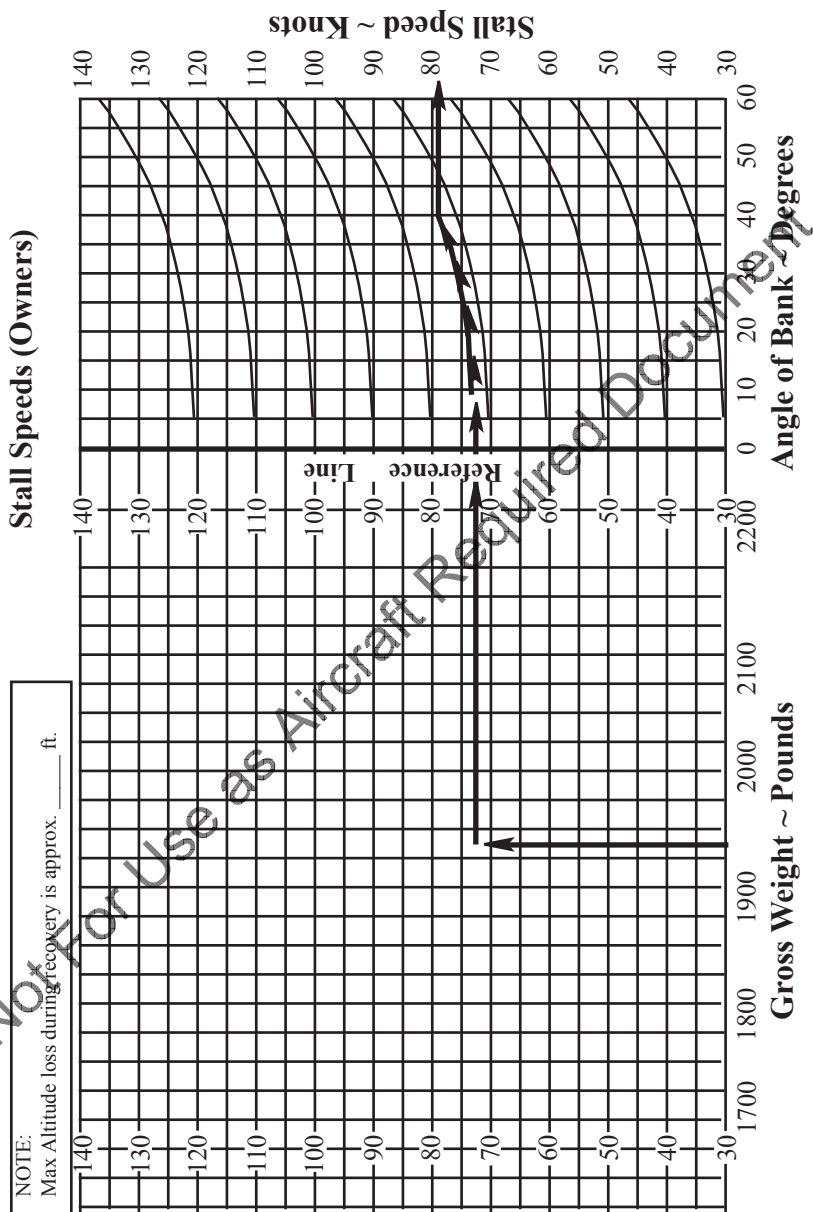
STALL SPEEDS

Aircraft stall speeds are a function of gross weight, flap position, and engine power setting for unaccelerated stalls. In addition, turning flight adds effective weight as a function of bank angle (i.e. 60° bank while maintaining level flight equals twice the effective gross weight). Stalls should be conducted from minimum to maximum weights, three flap positions, and appropriate power settings (idle and T.O.).

These tests should be conducted at altitudes such that should a spin inadvertently occur there is sufficient altitude for recovery. Three thousand feet AGL is recommended. As the aircraft is decelerated slowly, altitude should be maintained and notes made as to what speed the stall warnings are initially felt and when the aircraft fully stalls. Sufficient stalls should be conducted to define the repeatability at any one condition, and at three or four weights such that a line can be drawn thru the speed points to form a line for cruise and landing configuration.

Stalls should cover both the cruise configuration and the landing configuration with the gear and flaps in the full down position. Intermediate flaps would be the final data to obtain. Be **sure to note the altitude lost on each stall** so that the Note can be filled in on your “Stall Speeds (Owners)” chart.

Once your stall speed lines are defined, the values can be corrected for bank angle by using the chart for bank angle effects. The chart is used by entering at the gross weight, moving vertically up the chart until intersecting the appropriate line, then horizontally right to the reference line, then following the line until reaching the degree of bank desired then horizontally again to the right scale.



Stall Speed Chart for _____

TAKEOFF DISTANCES

Takeoff distances are a function of pressure altitude, gross weight, wind component and outside air temperature. Runway slope and surface type (grass, slush, etc.) can lengthen your required takeoff distance significantly. Takeoff flaps reduce the number slightly. Takeoff distance is broken into two segments, ground roll and distance to clear a 50 foot obstacle. Significant differences can result from both aircraft and pilot technique so it is recommended that you fly your aircraft and determine these “numbers” specifically. If your test runway has any significant slope, obtain some data in both directions to determine the effect of that factor. The latter is best checked at heavy weights.

These data can be obtained as described below. They should be obtained after the static source, the airspeed and the stall speed tests have been accomplished. **Be sure to make any corrections to your indicated speeds when you define your “V_r” and “V” for these tests (65 and 102 KCAS respectively).**

Pick a time when airport traffic is minimal, the wind is calm and a “brakes release” point. Coordinate with the “tower” personnel and obtain the necessary support personnel. Station them down the runway (with distance markers on it) such that one can pick off the lift-off point along the runway and the other can estimate your distance at the 50 foot altitude. (This will take some practice to judge, and a copilot calling “Mark” based on your indicated altitude can help the ground spotter pick your “50ft” distance. Estimate your gross weight for each takeoff and make multiple runs to define the scatter. It is suggested that you plot each point on a chart to show the data scatter, then enter the data on the chart.

Associated Conditions:

T.O. Pwr - Set before brakes release

Flaps - UP, (Takeoff)

Gear - Retracted after Lift Off

Runway - Paved

Notes:

• Decrease distance 4% for each 5 Kts headwind

• Increase distance by 6% for each 2.5 Kts tailwind

Weight LBS	Takeoff Speed KCAS		Pressure Altitude	0°C, (32° F)	
	Lift off	50 ft		Ground Roll	Clear 50 ft
1800	65	75	SL 2000 4000 6000		
2000	65	75	SL 2000 4000 6000		
2200	65	75	SL 2000 4000 6000		

Weight LBS	Takeoff Speed KCAS		Pressure Altitude	20°C, (68° F)	
	Lift off	50 ft		Ground Roll	Clear 50 ft
1800	65	75	SL 2000 4000 6000		
2000	65	75	SL 2000 4000 6000		
2200	65	75	SL 2000 4000 6000		

Weight LBS	Takeoff Speed KCAS		Pressure Altitude	40°C, (104° F)	
	Lift off	50 ft		Ground Roll	Clear 50 ft
1800	65	75	SL 2000 4000 6000		
2000	65	75	SL 2000 4000 6000		
2200	65	75	SL 2000 4000 6000		

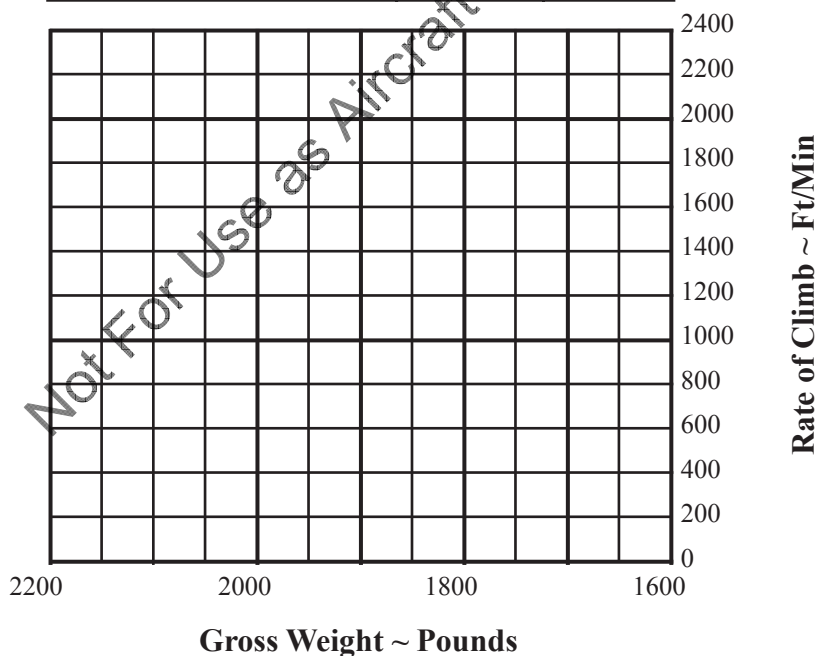
Take-off Distance Data for _____

RATE OF CLIMB

Your Rate of Climb is a function of gross weight, pressure altitude and outside air temperature. It assumes full power, (leaned at higher altitudes), climb at 150 kts IAS, with flaps and gear up. This data can be obtained during normal cross-country flights with a little preplanning to record the data. It is suggested that data of OAT, rate of climb, and gross weight be recorded whenever possible, then when sufficient data has been generated over a temperature and weight range the data can be added to the chart below.

Rate of Climb

ASSOCIATED CONDITIONS:	Gross Weight	Cruise climb Airspeed
1. Power - Maximum throttle 2. Flaps & Gear - UP 3. Mixture - Lean to Max EGT	Alt	140 KIAS



Rate of Climb for _____

CRUISE SPEEDS

As with the climb chart data, your actual cruise speed data can be recorded during normal cross country flights. Your engine's power setting (rpm, altitude and manifold pressure) for the flight must be converted to HP for your actual cruise power setting. The engine manual for your engine model will contain such horsepower availability data. You should also find a chart such as the "Part Throttle Fuel Consumption" chart from which you can establish your fuel burn rate. The faint dotted lines (as shown on the sample, next page) may be added, faired thru your data.

OTHER CHARTS

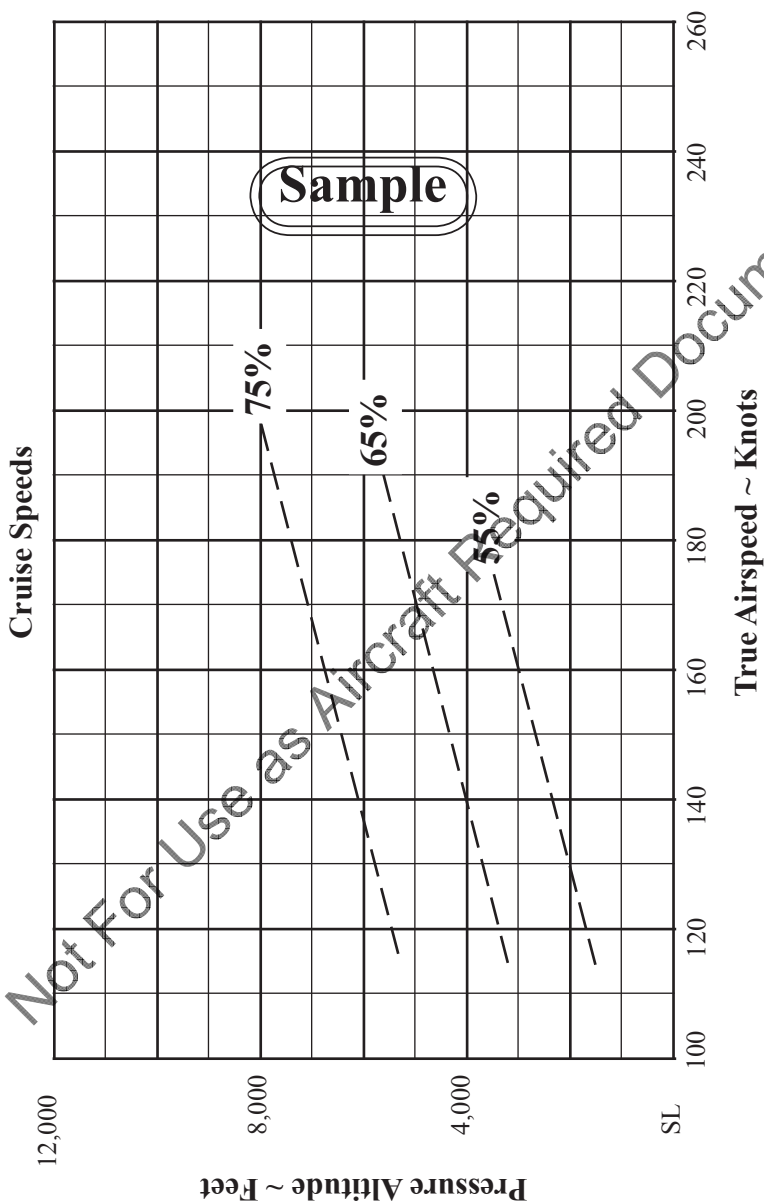
Several other charts of a general nature are included for your use. The aforementioned "Part Throttle Fuel Consumption" chart for one common engine is shown. If this is not your engine, your engine's manual will have a similar chart, and it is recommended that you include such a chart (photo reduced to fit) in your POH.

A chart of the International Standard Atmosphere as well as a Fahrenheit to Celsius conversion chart are included for your reference and convenience.

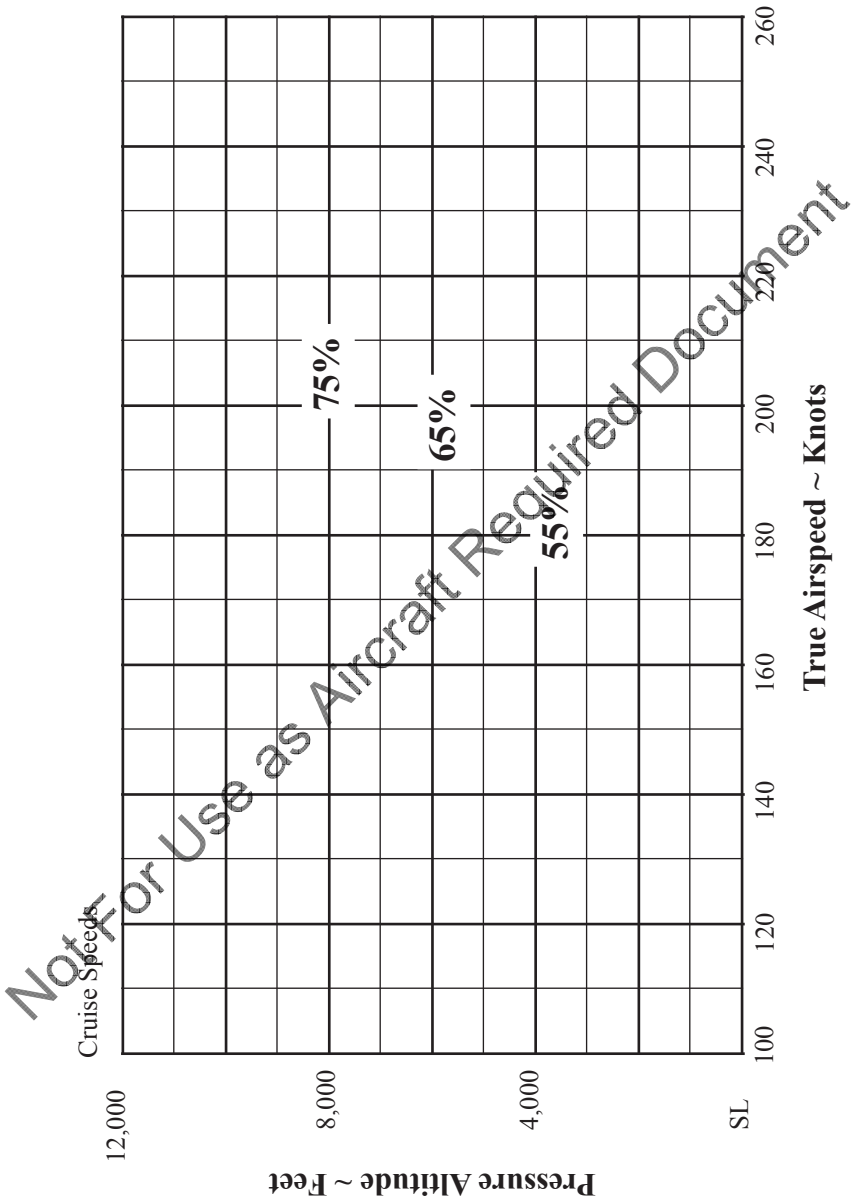
SUMMARY

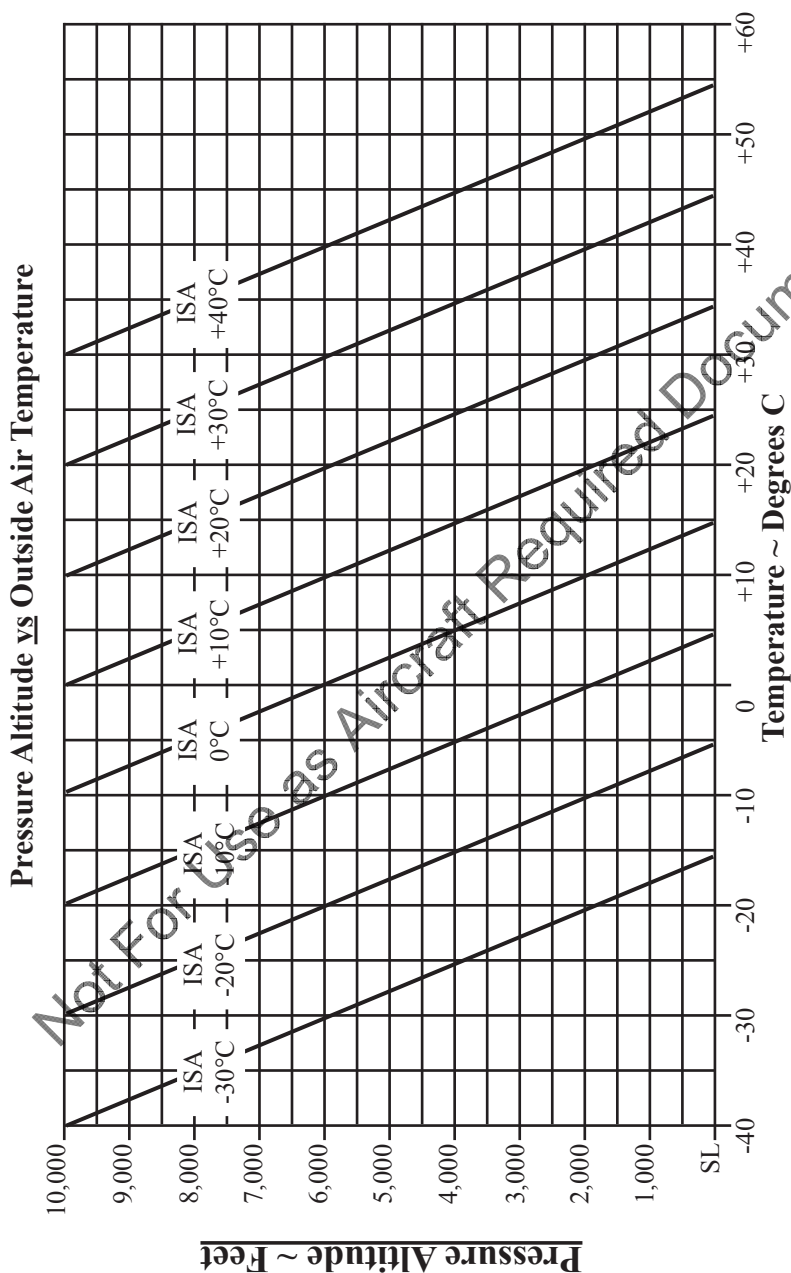
While all this performance data may at first seem to be excessive, when completed as outlined, you can take pride in having truly explored the capabilities of your particular machine as well as your piloting technique. When completed you will have a truly professional document to match your outstanding Lancair aircraft.

SAFE & HAPPY TESTING !

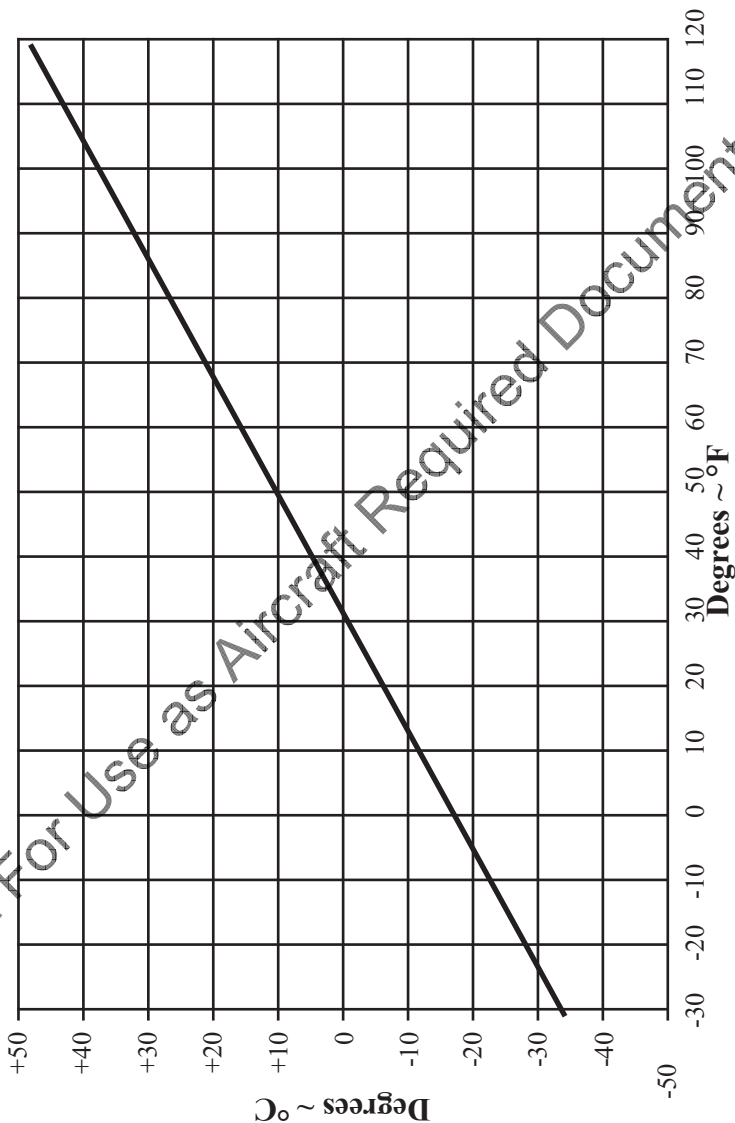


Sample Cruise Speed Data





Fahrenheit to Celsius Conversion



Temperature Conversion



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WEIGHT AND BALANCE / EQUIPMENT LIST

SECTION VI

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Weight and Balance

The center of gravity instructions will eventually be published in the Pilot's Operating Handbook. In the meantime we'll publish the procedures in the newsletter.

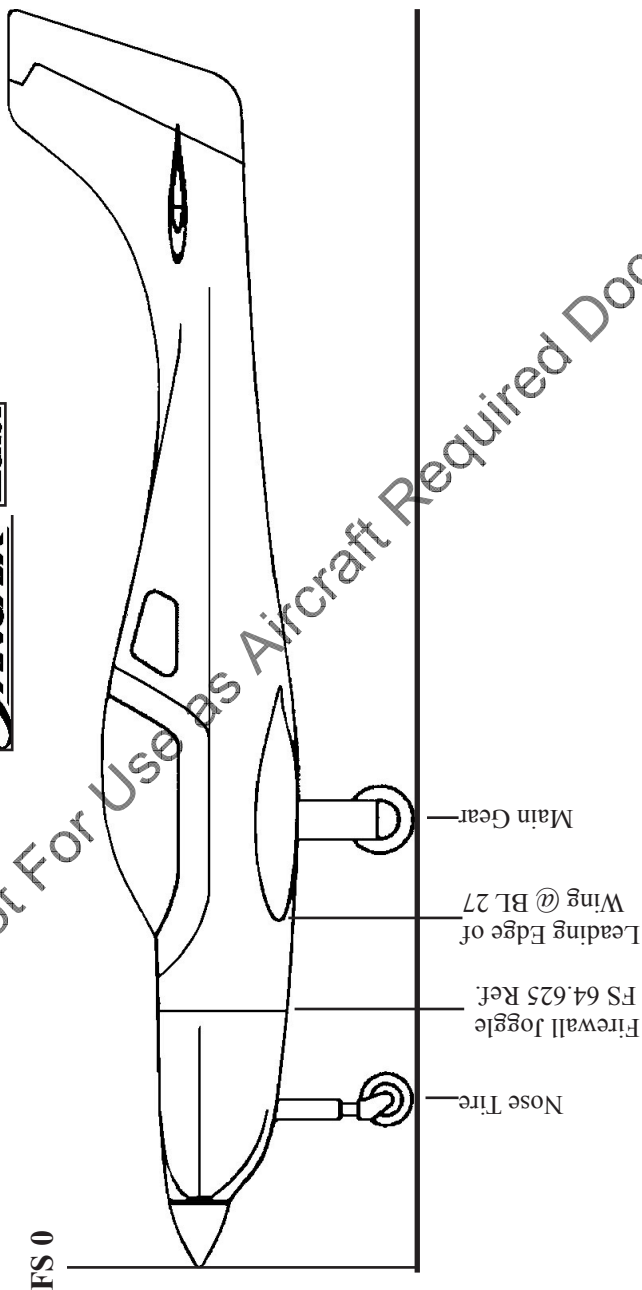
Center of Gravity: The center of gravity is simply a point at the airplane where it balances statically. It changes as you load the airplane. It changes in flight as you retract the gear and use fuel and oil. Proper center of gravity is absolutely critical to the safe flight.

WARNING

It is very important that the scales used are accurate. Bathroom scales are not considered accurate! Flying outside the approved center of gravity envelope is dangerous. You may need to borrow or rent accurate scales from your local FBO. For weight and balance of your Legacy the scales should handle up to 1000 lbs.

Make sure that you follow the procedures described below to accurately measure the aircraft stations for your aircraft. Sample graphs/tables are provided as examples, but do not use that data in figuring the numbers for your aircraft.

Measuring Locations



Record the following:

Nose Tire FS _____

Main Ger FS _____

Center of Gravity Envelope: _____

Leading Edge of Wing @ BL 27 _____

+ 5.98" _____ = forward limit

+ 12" _____ = aft limit

+ 1.96" _____ = leading edge of MAC

Step 1: Establishing Fuselage Stations

The first thing we need to do is to record the locations of the nose gear and the main gear, and the leading edge of the wing at BL 27.

- Level the aircraft by leveling the longerons. Pick a spot close to the the center of the longerons where they are the straightest. Use a SMART level or similar tool to level the airplane. Normally you will have to raise the tail somewhat to level the aircraft. At the same time, secure the aircraft so it will not move.
- Start by establishing the aircraft centerline on the floor. Plumb bob off the center of the firewall and then plumb off the center of the fuselage as far aft as possible. Connect the marks to form the aircraft centerline.
- The starting fuselage station reference is the firewall joggle. Drop a plumb bob off the left and right side of the fuselage to create reference marks on the floor. Connect with a line. This represents FS (fuselage station) 64.625.
- Nose gear: drop a plumb bob off the center of the nose gear axle.
- Main gear: drop a plumb bob off the center of both the main gear axles. Snap a chalk line between the two axles.
- At (BL) butt line 27 drop a plumb bob off the leading edge of the wing on each side. Again connect the dots to form the reference from which the MAC (mean aerodynamic chord) will be established.

NOTE:

You must take your own measurements off your aircraft and not use the numbers off the illustrations. Each aircraft is a little different.

Step 2: Weighing the Aircraft

Next the aircraft is weighed. Be sure the aircraft scales have been “zeroed” if required. It is critical that the aircraft is also leveled on the scales. There are several ways to do this. Perhaps the easiest is to start by deflating/inflating tires to achieve level. Note: Do not support the aircraft when on the scales as this will change the outcome of the weight and balance!! The canopy must be closed while taking numbers. Keep in mind that if the aircraft is not upholstered or painted all these numbers will change. We suggest that for records you record the weight on each main gear separately.

- a) Weigh the aircraft empty. To accurately weigh the aircraft empty all fuel should be drained from the wings and the engine should contain a normal amount of oil.
- b) Repeat measurements with a pilot.
- c) Repeat measurements with fuel. We suggest you fill the tanks approximately half full.
- d) While you have the aircraft on the scales you may want to record numbers off different load configurations such loading up the baggage compartment for future reference. Note that this can also be calculated based on fuselage stations.

You now have all the information you need to compute the weight and balance for your aircraft.

Step 3: Compute Empty Weight and Balance

Item	Weight (lbs.)	x	MomArm (inches)	=	Mom. Wt (lb-inches)
Nose Gear		x		=	
Main Gear		x		=	
Total					

Add up the total moment weights and divide by total weight

Example:

Item	Weight (lbs.)	x	MomArm (inches)	=	Mom. Wt (lb-inches)
Nose Gear	515	x	50.125	=	25814.375
Main Gear	958	x	104.25	=	99871.5
Total	1473				125685.875

Empty weight: 1473 lbs C.G.: FS 85.32

Step 4: Compute the individual Components Weight and Balance

In step two you weighed the aircraft under several different conditions (with pilot, then with fuel, etc). This will be used to determine the center of gravity for these individual items.

To get the individual moment arms use the following equation:

(total moment weight – empty moment weight) / weight of item

Total moment weight are the moments from the weighing with the item and the empty moment weight is the moment weight when the aircraft is in the empty condition.

You first weighed the aircraft empty from which you obtained an empty total moment of 125685.875 lb-inches (see step 3). Then you weighed the aircraft with a pilot on board and let's say you recorded 498 lbs on the nose gear and 1181 lbs on the mains. From the difference in weight we know the pilot is 206 lbs (needed for calculation).

Total moment weight:

$$(498 \text{ lbs} \times 50.125'') + (1181 \text{ lbs} \times 104.25) = 148,081.5 \text{ inch lbs.}$$

$$\text{Moment arm} = (148,081.5 - 125,685.88) / 206 = 108.72 \text{ inches.}$$

In explanation, the center of gravity of the pilot is at FS 108.72

Repeat this calculation to determine fuel. If you would like you can also do it for the baggage compartment or you can use the number provided for the center of the baggage compartment of FS 141.

Step 5. Complete the Weight and Balance Form

Fill in the form and compute the center of gravity.

Note:

For your center of gravity calculations account for minimum fuel. In explanation, you will always have unusable fuel in the wings which should be accounted for.

General Comments:

Mean Aerodynamic Chord (or MAC) is an imaginary wing chord used for reference to weight and balance and other computations. The Legacy center of gravity range is approved from 10 to 25% of mean aerodynamic chord. The C.G. location in terms of percent MAC is easily calculated as shown in the weight and balance sheet. It provides a simple reference for C.G. location for comparison sake.

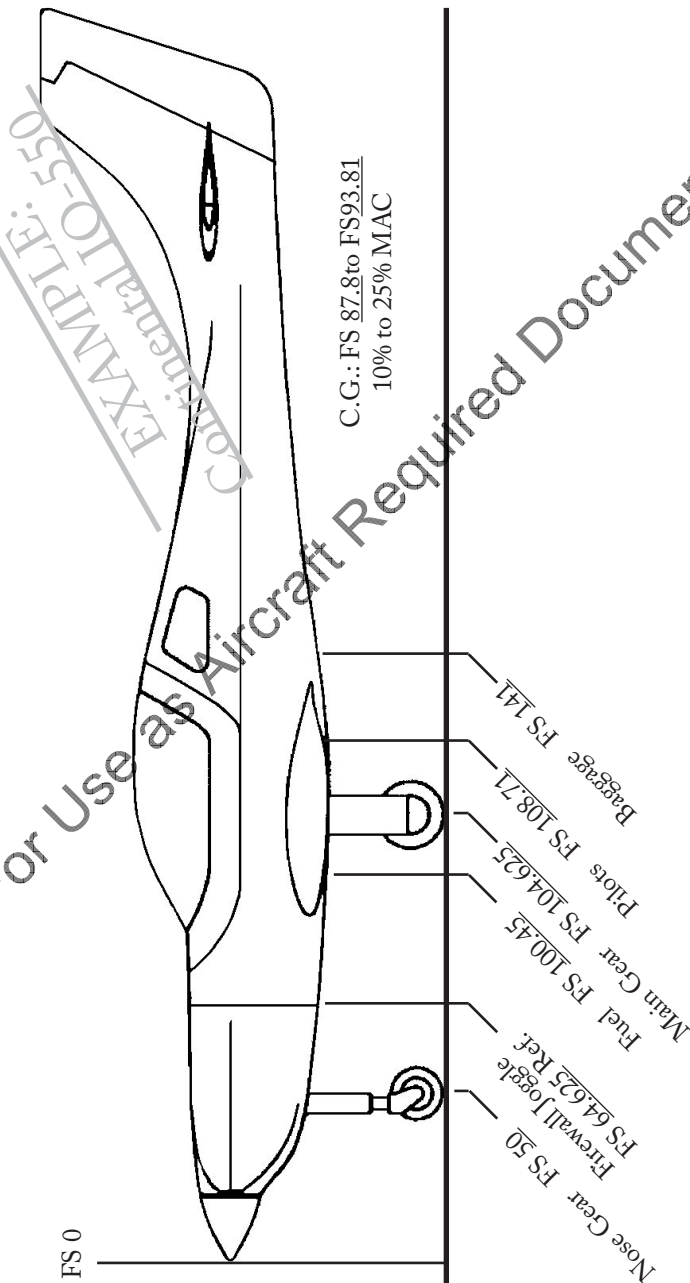
The pilot must be aware of the effect on the various loading configurations. In general a forward C.G. improves the stalling behavior and improves aircraft stability. Aft C.G. will in general worsen stall behavior and aircraft stability. Changes in the center of gravity will change the trim of the aircraft. Also be familiar with the effect of aircraft weight. A higher aircraft weight decreases aircraft performance and raises the stall speed. The entire flight envelope should be explored by the pilot to become familiar with the aircraft. We stress that aft C.G. and higher weights should be experimented with very cautiously. The minimum altitude for practicing stalls in the Lancair Legacy is 5,000 feet.

Understanding Max Zero Fuel Weight. The Legacy is subject to a max zero fuel weight of 1,900 lbs. That means that anything beyond 1,900 lbs loaded in the aircraft must be fuel. In other words the weight of the aircraft minus fuel must be less than 1,900 lbs.

Be aware that the center of gravity range for the airplane changes as you burn fuel. In the Lancair Legacy this causes the center of gravity to slowly move forward.

We suggest you set up a spread sheet for your aircraft to easily compute all the possible scenarios for your aircraft.

WEIGHT AND BALANCE SHEET



EXAMPLE:
Continental IO-550

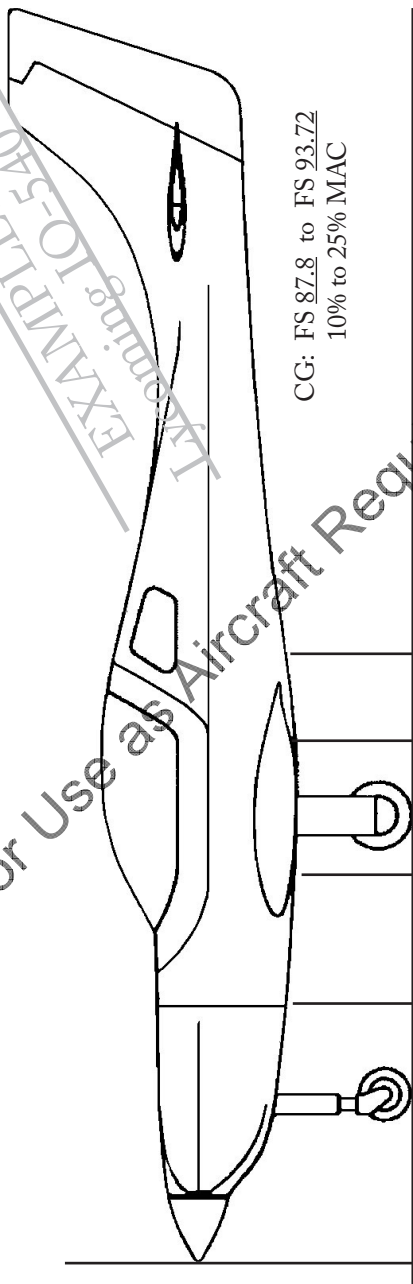
Registration Number: N975BA Owner: _____

Item (lbs.)	Weight (inches)	Arm lb. inches	Moment
Empty Aircraft	1553	87.94	136470.82
Fuel	360	190.45	36162
Pilot	200	108.72	200
Co-Pilot	0	108.72	0
Baggage	50	141	7050
Total Weight	2163	Total Moment:	201526.82

C.G. = Total moment / Total Weight = 93.17
 % MAC = 21.38%

Percent MAC = C.G. - Leading Edge of MAC 40.16	x 100%
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WEIGHT AND BALANCE SHEET



- Nose Gear FS 50.125
- Firewall Joggle FS 64.625 Ref.
- Fuel FS 100.45
- Main Gear FS 104.25
- Pilots FS 108.71
- Baggage FS 141

CG: FS 87.8 to FS 93.72
10% to 25% MAC

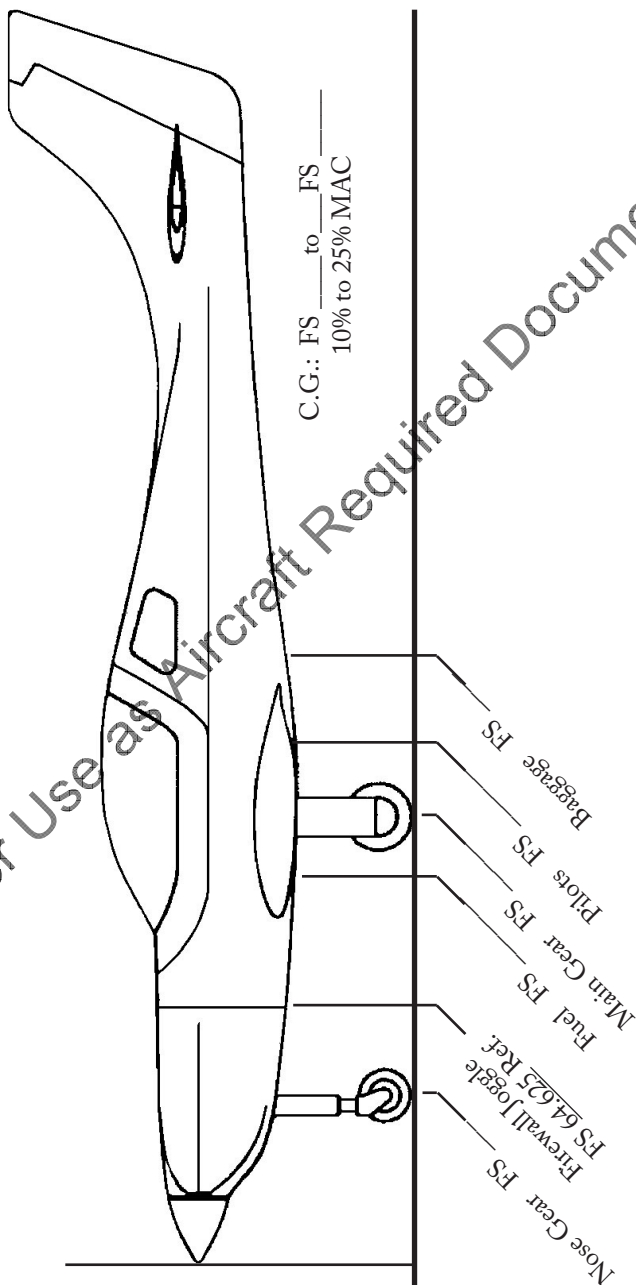
Registration Number: _____	Owner: _____
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Item (lbs.)	Weight (inches)	Arm lb. inches	Moment
Empty Aircraft	1473	85.32	125685.88
Fuel	210	100.45	21094.5
Pilot	180	108.72	19568.99
Co-Pilot	180	108.72	19568.99
Baggage	50	141	7050
Total Weight	2093	Total Moment:	192968.36

C.G. = Total moment / Total Weight = $\frac{92.19}{2093}$
 % MAC = $\frac{92.19}{2093} \times 100\%$

Percent MAC = C.G. - Leading Edge of MAC	x	100%
40.16		

WEIGHT AND BALANCE SHEET



Registration Number: _____	Owner: _____
----------------------------	--------------

Item (lbs.)	Weight (inches)	Arm lb. inches	Moment
Empty Aircraft			
Fuel			
Pilot			
Co-Pilot			
Baggage			
Total Weight		Total Moment:	

C.G. = Total moment / Total Weight = _____
 % MAC = _____ %

Percent MAC = C.G. - Leading Edge of MAC	x	100 %
40.16		

NOTES:

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SYSTEM DESCRIPTION

SECTION VII

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GENERAL

Having constructed your Lancair, you are probably quite knowledgeable of its general construction and physical characteristics. Herein are included general systems descriptions applicable to all Legacys. Your system may be slightly different if you have added your own “bells and whistles” and account should be made thereof. A “notes” section is added at the end of the sections for your entries in this regard. During construction, you should make certain that any modifications made are of aircraft quality and preferably Lancair approved.

NOTE

This section is intended to provide the pilot with basic knowledge of the aircraft. A basic knowledge of the aircraft and its systems is essential to the safe and proper operation of the aircraft.

This section is not intended to be used as a maintenance or parts catalogue. Refer to the construction manual for detailed systems descriptions. The construction manual also serves as a parts reference.

AIRFRAME

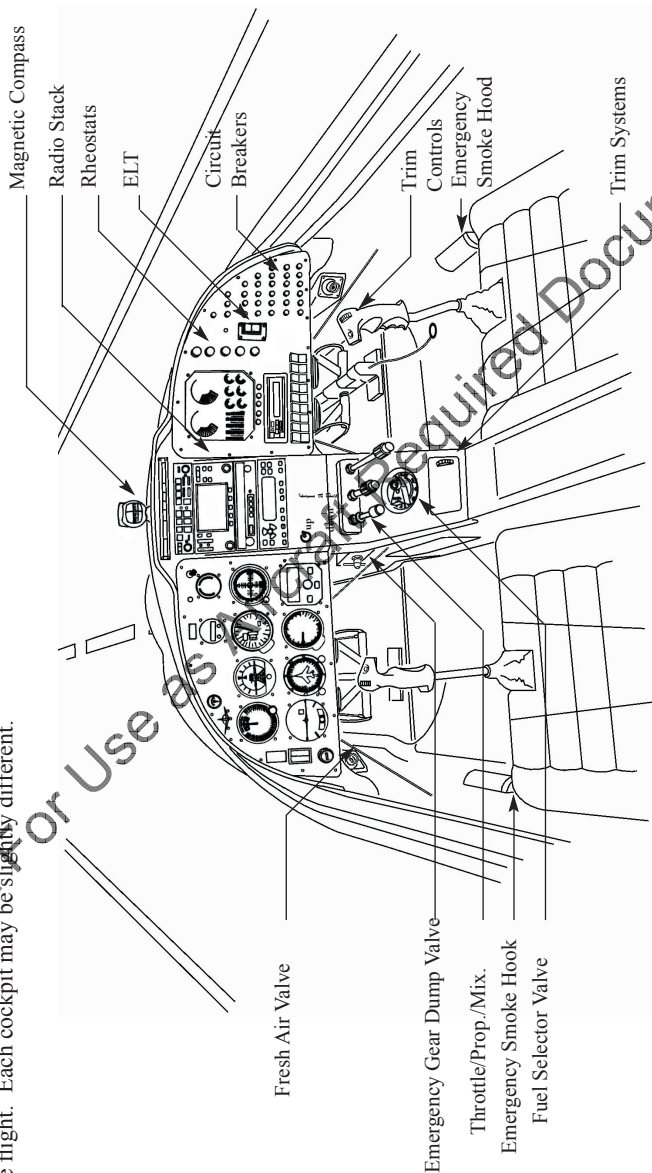
Your Lancair is constructed of the highest aircraft quality materials. Accordingly your construction techniques should match that quality. Following the assembly manual should cover most if not all your questions concerning the various techniques involved.

Materials

The Lancair Legacy wings are fabricated of high temperature prepreg carbon fiber glass skins over a high temperature or Nomex honeycomb core. The wings, empennage and fuselage major parts are oven cured at 270°F at pressure of nearly 2000 lbs/sq.ft. These are similar to almost all modern commercial transport construction methods and materials meeting such standards regarding traceability and fire resistance, and the manufacturing facilities equipment meets FAA requirements. In addition, the resin systems used are low in styrene and are safer to handle and use than are most other systems. Read and obey all material handling warnings at all times.

Typical Legacy Cockpit

It is essential that you familiarize yourself with the cockpit before flight. Each cockpit may be slightly different.



FLIGHT CONTROLS

The Lancair Legacy is conventional in its control configuration. The ailerons and elevators use push-pull tubes with bearing mounts and rod end bearings providing smooth controls. The rudder control is via stainless steel cables. The flaps are fully electric. A single flap motor drives a linear actuator and operates the flaps thru a torque tube.

TRIM CONTROLS

The Lancair Legacy comes standard with pitch and roll trim controls. The rudder trim control is optional. All three systems use an electric servo that deflects a trim tab. Prior to the first flight verify that the servos move in the proper direction. The control surface always moves in the opposite direction of the tab. For example, if the elevator trim tab moves down it causes the elevator to move up resulting in pitch up. A loose trim can be disastrous therefore it is very important that it is properly secured. As you build time in your aircraft you will become familiar with the trim tab positions for the different configurations. It is essential that all trims are set in the correct positions prior to takeoff. Both the rudder and elevator trims have position indicators, however for roll you can determine approximate position by looking at it.

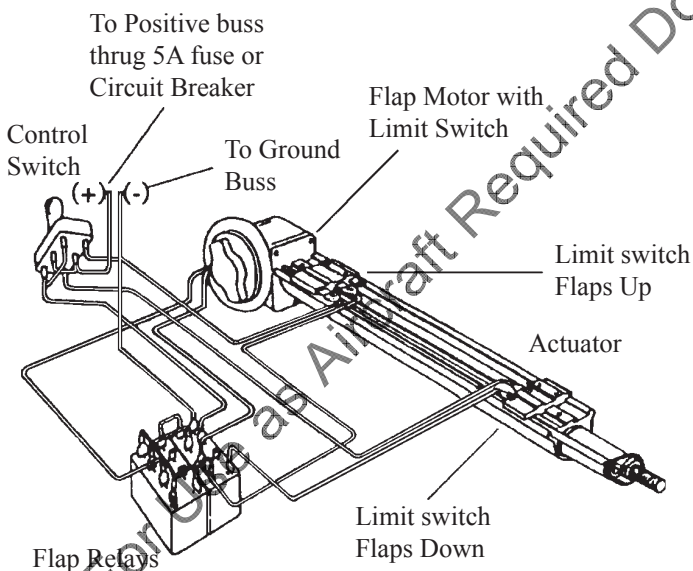
GROUND CONTROL

The Lancair is controlled on the ground using differential braking of the toe brakes located on the upper portion of the rudder pedals. A little caution for the first few times in the aircraft is all that is required to get the feel of this simple and light weight approach. Over-the-nose visibility is such that this approach is easily mastered. Initial use of the brakes during taxiing should be cautious but positive to "set" the pads and disks. Brakes should be used sparingly during the takeoff roll obviously, and rudder control can be expected to begin after about 35 kts indicated airspeed.

The standard Lancair is fitted with 5.00 x 5 wheels on the main gear. These tires are essentially scaled down "500x5" tires. The nose gear are five inch wheels with Lamb tires.

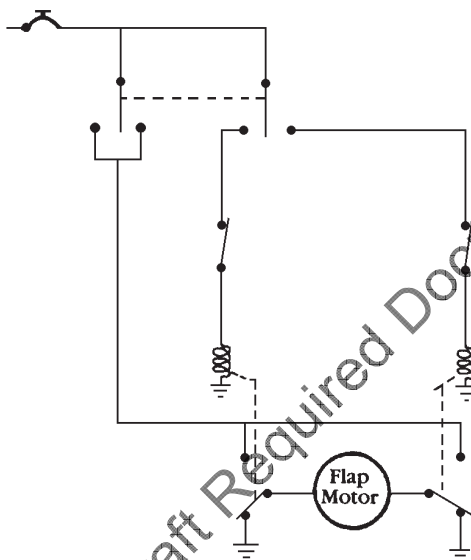
FLAPS

The flaps are electrically operated by a single electric two-way motor. The motor drives a jack screw which in turn extends and retracts the flaps. The figure below shows the flaps system in schematic form. The standard technique for establishing “approach “ flaps is to time the application of the down flap power. Full up and full down are determined by the setting of microswitches which deactivate the motor. Power for the flap motor comes from the primary electrical buss. A flap electrical schematic is shown on the next page.



Flap Wiring Layout

Seen again later
in this section,
shown here for
completeness



Flap Electrical Schematic

LANDING GEAR

The Lancair main gear is the air/oil oleo type. The gear is fully retractable driven by an electric/hydraulic system.

The retractable nose gear strut is similar to the main gear except that it pivots. The strut is self centering meaning that when it extends it centers. This is to ensure that it is centered as it retracts into the nose gear well.

Gear Operations

In the fully extended position, the gear linkage is over-centered. In its retracted position the gear is held up by system pressure. Retracting the gear is accomplished by activating the gear up switch. This initiates the pressure buildup (to 1200 psig) by the hydraulic pump, unlocks the over-center links and raises the gear. Each gear has its own hydraulic strut with its own limit switches.

WARNING

Operation of the pump is limited to 20 seconds after which a 5 minute cooling period is required.

As the gear becomes fully retracted and pressure builds up, pump operation should be limited to 2 to 3 seconds due to the rapid heating in this “bottomed out” high pressure condition.

Extending the gear is accomplished by activating the “down” switch which initiates the low pressure side of the hydraulic pump (550 psig) and this pressure lowers the gear.

A gear dump valve in the cockpit connects the high and low pressure sides of the pump bleeding the normal “up” pressure off thus allowing the gear to extend by free falling. When this valve is activated the nose wheel will be pushed down by the pressure in the gas strut, and the main gears by their weight. A typical dump valve is shown below and is located under the instrument panel on the left side of the center console. by the pilot’s right knee.

NOTE

This valve is located by the pilot’s right knee. Its operation should be checked periodically.

NOTE

Following use of the dump valve, some yawing of the aircraft may be required to obtain “three green” if flight speeds are excessive upon extension or if some gear adjustments are in order. If a malfunction requires the use of the manual gear extension subsequent retracting of the gear should not be accomplished prior to a thorough ground check-out.

The nose landing gear doors are mechanically linked to each gear and as such should not require adjustment. The main gear has two sets of doors per side. The outboard gear doors are mechanical and should not require any adjustment. The inboard

gear doors are actuated by a sequence valve that powers a hydraulic cylinder. The accessible portion should be inspected prior to every flight. The linkage and microswitches should be part of every preflight inspection and be given a particularly close look following any inadvertent extension or when flight to speeds above the recommended gear operating speed has occurred. The inspection should look for loose or bent linkages and abrasion type wear.

The hydraulic reservoir should be checked periodically for fluid level and security of lines. Obviously chafed lines, leaks, bent arms or any excessive wear anywhere in the system should be corrected promptly to preclude more serious problems.

BAGGAGE COMPARTMENT

The baggage compartment is located directly behind the passenger seats. Its capacity is noted on a placard but should never exceed 75 lb. pounds for the Lancair. The aircraft weight and balance may limit the maximum baggage to less than the maximum stated herein.

All baggage carried should be secured for every flight. Even a flight in smooth air could encounter unexpected clear air or wake turbulence or require an evasive maneuver which could change loose baggage into control jamming debris and become a hazard to the flight anywhere from a nuisance to being catastrophic.

**ANTICIPATE THE LIKELIHOOD OF NEGATIVE G
FLIGHT CONDITIONS FOR EVERY FLIGHT!**

SEATS, BELTS & SHOULDER HARNESS

Your Legacy is fitted with seat belts and shoulder harnesses. The seat cushions serve two purposes. First and foremost the seat cushions should be safe. Safe cushions provide proper back and seat support in case of emergencies, that is in case of an accident they should not be so soft as to not provide support under high g conditions. They should not support combustion or give off toxic fumes when subjected to fire or an ignition source. Of course, in addition, they should also be comfortable so that a backache is not a result of every flight. Always adjust your belt to secure you into the seat firmly for takeoff and landings. The pilot (or one pilot) should always remain belted throughout the flight.

The shoulder harness is perhaps your greatest cockpit lifesaver for takeoff and landing emergencies. Always use it if you have it installed or install it if you have not done so already. As with any seat belt, the shoulder harness has to be snug to

work to your best advantage. Always make sure any uninitiated passengers know how to secure and release their belt and harness without relying on you.

CANOPY, WINDOWS AND EXITS

The canopy is hinged in the front. The weight of the canopy is offset by gas struts that make it seem weightless. In the closed and locked position it is secured in position by two latches that go over center.

Normal access to the baggage compartment is provided thru the cockpit and over the seat backs.

Entrance and exit of personnel from the cockpit is via the canopy. In case of an emergency forced landing the two aft latches may be loosened on final approach to aid in quick egress after coming to a complete stop. For further information and discussions consult the emergency section of this handbook.

CONTROL LOCKS

The normal control lock for the Legacy is the use of a seat belt secured over one or both of the control sticks. We highly recommend that you use some sort of rudder gust lock. And while we would all like to have a hangar for our machine, those of us who are not so lucky may have to resort to some additional protection for severe weather. This can be provided by battens for the ailerons, elevators and rudder. These battens are simply padded pairs of board such as 3" by 4" by 3/8". They can be slipped over and under control surface intersections with fixed sections and held firmly in place with a small bolt with a wing nut. Such battens will keep tail wind airloads from loading the surfaces abnormally. Wheel chocks and tie-downs go without saying. Another technique that can aid if high winds are expected involves the use of spanwise spoilers on the wings. In all cases be sure to secure such devices in a manner that precludes their coming free and causing damage that they are designed to preclude.

ENGINES

General Information

The Lancair Legacy is designed for the Lycoming 540 and the Continental 550 engines. These airframe/powerplant combinations result in a superb cross country aircraft.

These engines are FAA certified aircraft powerplants of 6 cylinder opposed, air

cooled design provided with magnetos for ignition, a starter and alternator. The simplicity of these powerplants aids in their reliability providing they are given the care such a mechanical device requires. Since this is your only source of power for flight it only makes sense to give it that extra bit of care so that it can take care of you hour after hour.

CONTINENTAL AND LYCOMING

Engine Controls

All engines are equipped with dual magnetos which are shorted in the OFF position. It is mandatory that operation of the mags be checked prior to each flight. In the normal operations section of this manual the proper run-up checks are described. Operation on either magneto should be smooth or the flight should be aborted and the problem resolved. The propeller should never be rotated on the ground without assuming that the mags are “hot” and the OFF position should be checked for operation by briefly switching the mags to the OFF position while at idle rpm prior to each shutdown. Normal shutdown then is accomplished by putting the mixture control in the cut-off position, running the engine dry of fuel.

All engines utilize a throttle to control the amount of airflow into the engine, restricting it with a butterfly (throttle) valve in the intake system. Full throttle allows unrestricted airflow into the engine resulting in manifold pressures up to ambient or even greater if you have some form of ram air pressure recovery system, resulting in maximum power output.

Controllable propeller engines also have a prop control which controls the engine R.P.M. and maintains it at a set level. Maximum engine RPM at maximum throttle settings are desired for takeoff. Cruise power settings reduce engine rpm commensurate with manifold pressure.

Fuel/air ratio is also controlled to compensate for the large air density changes due to operation at altitude. This mixture control reduces the fuel quantity provided to the engine from “Rich” to “Lean.” Leaning should be accomplished in accordance with the engine manufacture recommendations.

Engine Instrumentation

Oil: Oil, the life blood on an engine is of prime concern. Oil quantity is only measurable prior to flight and is a mandatory item in the checklist. Perhaps the most important measurement during operation is oil pressure. Oil temperature is another valuable measurement. Proper oil type and viscosity per the engine manufacturer’s

recommendation must be used. This is particularly important for the breaking in of a new engine. For specifics see the manufacturer's engine operating manual for recommendations for *your* engine.

RPM: Fixed pitch propellers have blade angles such that with full power being developed by the engine the R.P.M. is limited to less than its allowable RPM. Controllable propellers are likewise limiting (by changing pitch of the blades) to keep the engine rpm under dangerous levels to prevent overstressing the rotating parts.

High speed descents at high power settings with a fixed pitch propeller may allow overspeeding of the engine, thus RPM needs to be monitored closely.

CHT: Cylinder head temperature is a measure of engine cooling airflow and is a measure of an adequately warm engine to accept full power for takeoff. Since the Lancair is tightly cowled, high power settings at low airspeeds (slow climb speeds for example) should always be monitored for high CHT readings. Excessive CHT levels will result in damage and/or reduced engine life. Poor cooling can also result from improper baffles, bird nests in the engine compartment, etc. and must be avoided.

EGT & Engine Monitors: A measure of optimum fuel/air ratio is available by sensing the temperature of the exhaust gases. Operating the engine at or near its peak exhaust temperature means that you are operating at the near optimum fuel/air ratio. Exhaust gas temperature is kept within limits indirectly by establishing the proper mixture for that power setting. A direct measurement of EGT is common and many devices are available in this regard. Some measure only the hottest cylinder, others measure all six. Some measure both EGT and cylinder head temperature, monitor both continuously and have alarms. Since an EGT is both a monitor of engine health and a means of proper mixture setting it is highly recommended and will pay for itself in the long run by reduced fuel consumption and engine maintenance as well as extended life. An added benefit of these multiple sensor systems is that trouble shooting is enhanced significantly and deteriorating situations can be seen early and caught before mechanical damage occurs or dangerous in-flight situations develop. These systems are also ideal for insuring that your new aircraft is properly baffled and sealed at the start.

Carbureted engines require a system to add heat to the intake air to eliminate ice which forms in the carburetor due to the vaporization of the fuel in the carburetor which lowers temperatures in the carburetor throat. This carburetor heat valve ducts air, warmed by the engine exhaust system, into the intake system. It is a variable valve, i.e., it can be modulated to provide partial hot air, but should generally be used "full hot" initially if ice is thought to be present. With the application of

this warmed air a power reduction will be noticed due to the less dense air being supplied to the engine. Upon clearing of the ice the heat should normally be returned to full cold. If a carburetor air temperature probe is installed (downstream of the throttle valve) the heat can be modulated to maintain the fuel/air mixture at slightly greater than freezing. Conditions prone to carburetor icing are high humidity air at temperatures of 20°F to 70°F. Since we seldom have humidity gauges, an indication of humidity should be obtained from the preflight weather briefing and from the clouds as seen enroute. Ice can be an insidious visitor, forming slowly, almost imperceptibly slowly or rapidly requiring an equally fast response to preclude engine stoppage - beware. Carburetor heat operation should be checked before every flight during your engine run-up just before takeoff. A noticeable rpm reduction will be experienced with the application of heat while at the mag check power setting.

Fuel injected engines spray the fuel into the intake manifold or near the intake valve and are far less prone to form ice in the intake system since there is no temperature drop due to the fuel vaporization at the throttle valve. These installations however generally have an equivalent valve termed "alternate air". This also utilizes an alternate source of air for the intake system which is somewhat warmed, but is primarily for protection from the formation of ice on the intake air inlet, screen/filter, or passageways. This valve may be spring loaded such that it opens automatically upon loss of intake air pressure or simply manually controlled. Know your system and check its operation often.

Engine Starting

Starting of the Lancair is simple. The aircraft is equipped with an electric starter which cranks the engine to provide the first of the three basic requirements (air, fuel, and ignition). Fuel is introduced by priming prior to cranking the engine.

After the engine starts adjust the RPM to approximately 1000 rpm and monitor the oil pressure. If no oil pressure is indicated within 30 seconds, shut down and determine the cause. This time may be slightly longer under abnormally cold conditions or with the improper grade of oil in the engine. Under these conditions it is highly desirable to warm the engine and its oil prior to starting to minimize engine wear and ease starting. Very cold temperatures will increase the normal oil pressure and following starts the engine rpm should be kept at idle or slightly above until oil pressure starts returning towards normal.

WARNING

The Lancair does not lend itself to hand starting (propping) due to its low profile and tricycle gear. This practice is very dangerous.

Accessories

All engines are equipped with an alternator as a source of electrical power to charge the battery and operate various items during flight. Proper operation of the charging system is evident if the running system voltage is between 14.2 and 14.8 volts dc. Since a charged lead-acid battery has a voltage of ≈ 12.1 to 12.4 volts the battery should be continuously charged while the engine is running. If no voltage measurement is available, an amp meter may show discharge (-) at low rpm conditions (indicating that current for operating the aircraft's equipment is coming from the battery) and charge (+) at higher engine rpm's indicating that the battery is being charged.

Another accessory you may have installed is a vacuum pump for operating certain flight instruments such as gyros. Its operation may be assessed by the level of vacuum it maintains. This should generally be between 4.8 and 5.2 inches of mercury. For IFR flying a small gauge is available for monitoring this vacuum and is highly recommended. Vacuum pump failures, like many others occur at just the wrong time and are often insidious as the gyro may just slowly wind down to become useless.

Fire Detection/Extinguishing

Built in fire detection is not provided nor is an extinguishing system. It is prudent to carry a fire extinguisher in your aircraft. It should be checked regularly as any extinguisher, and kept handy in case of need. Starting an over primed engine is the most likely time you may need the unit. If the engine backfires and catches fire, continue cranking the engine and attempt to draw the fire back into the engine where it belongs. If the radio is on, advise of your situation. If cranking the engine fails or cranking is not possible for some reason, introduce the contents of the extinguisher into the engine compartment via the cooling air outlets. After exhausting the extinguisher, remain clear of the aircraft. While your aircraft is made of fire resistant materials and its fumes are essentially non-toxic, it is nonetheless a flying fuel tank and must be treated as such.

Abnormal Operation

After a few hours of operating your Legacy you will become familiar with its operation from its flight controls to the engine. It is good practice to make written notes of how it is operating so that you can spot changes. These changes may be toward stabilizing or deteriorating indications and heed watching. From the engines standpoint, oil consumption for example will be high on a new engine and decrease over the first 15 to 50 hours and then stabilize. From this point it should remain stable for many hours until the rings begin to deteriorate with a corresponding increase in oil consumption. Should piston rings begin to stick an increase in consumption will generally be noted and corrective actions or repairs can be effected in a timely manner. Continuous monitoring of engine parameters such as oil pressure, CHT and EGT (individual and spreads) along with airspeed, altitude, temperature and power setting for example will be rewarded by an intimate knowledge of your engine, as well as reduced maintenance and vastly increased reliability. No small reward.

PROPELLERS

Your Lancair may be fitted with several different propeller/engine combinations. Care of any propeller is vitally important as it is a very highly stressed component. Loss of even a portion of a blade can be catastrophic in flight. Nicks and scratches cause stress risers and cannot be neglected. The repaired contour of any repair should be similar to the original contour to remain as close as possible to the same airfoil as before thus maintaining the same "lift" on each blade. In addition the repair must result in the nick being fully removed and the blade surface polished. Give your propeller care, respect its overhaul periods, and it will pull you thru many hours of flight.

FUEL SYSTEM

The standard Lancair has a very simple fuel system. The engine is fed only from the left or right fuel tank as selected by the fuel selector valve. On the firewall a gascolator with a filter is normally installed.

The Legacy fuel system is similar to that of most low wing aircraft. There is a left and right wing tank. Each wing holds 32 gallons. The fuel selector valve is located in the center console. The fuel selector allows the pilot to select between LEFT or RIGHT fuel tank or the "OFF" position.

Fuel System Schematic

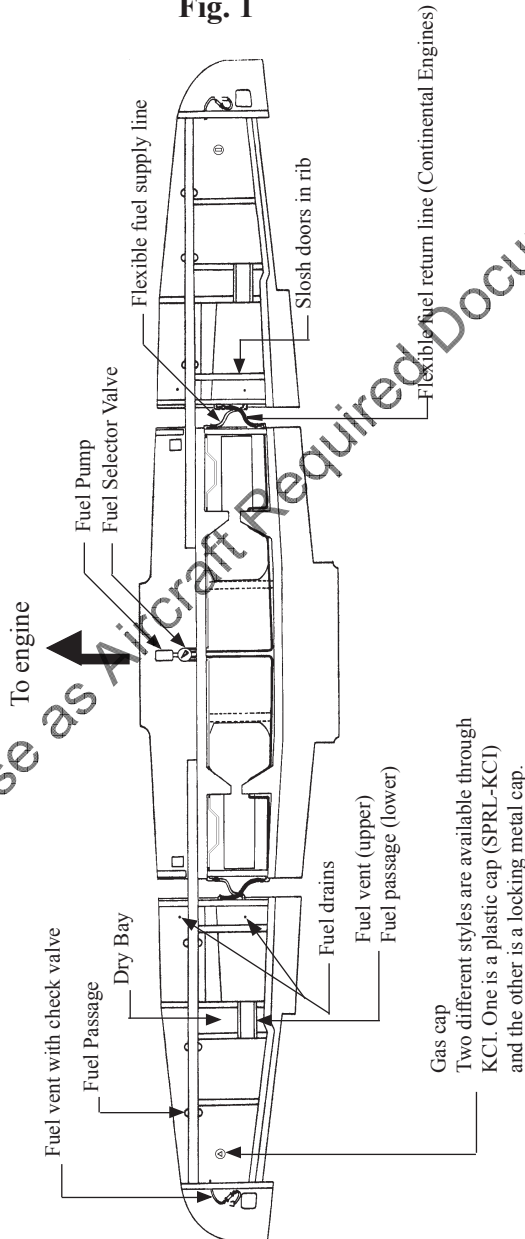
Fig. 1

RIGHT WING

Approx. Capacity 32 gallons.

LEFT WING

Approx. Capacity 32 gallons.



WARNING

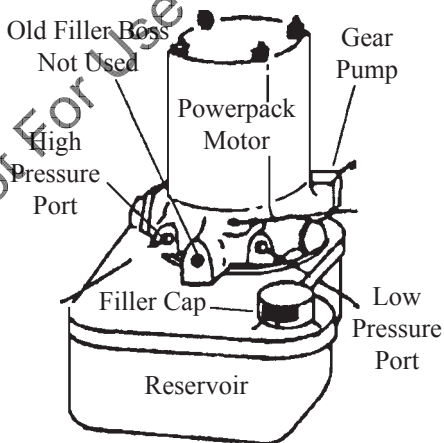
Do not install a fuel selector or modify your fuel selector to a “Both” position. Operating the Legacy with such a valve is considered DANGEROUS.

The Continental engine installations are slightly different from the Lycomings in that they have a fuel return system. Unused fuel is returned to the wings.

During the initial hours of operation keep a close eye on the fuel system. Verify that it is plumbed properly. For example if the left tank is selected there should be no changes in the right wing fuel quantity. (As an example fuel quantity could increase in the right wing indicating incorrect fuel selector valve clocking with the fuel return line.) See Fig. 1 Fuel System Schematic.

HYDRAULIC SYSTEM

A self contained hydraulic system is used to operate the landing gear. The pump is electrically powered. When the “gear up” position is selected the pump is activated and 1200 psi is provided to the up side of a piston operating the mechanism raising the gear (and in turn operating the gear doors). This pressure is maintained although the electric pump is disabled by an up limit pressure switch and the pressure holds the gear in its retracted position. Upon selecting the “down” position, 550 psi is provided to the down side of the cylinder and the gear is extended and driven to the overcenter locked position.

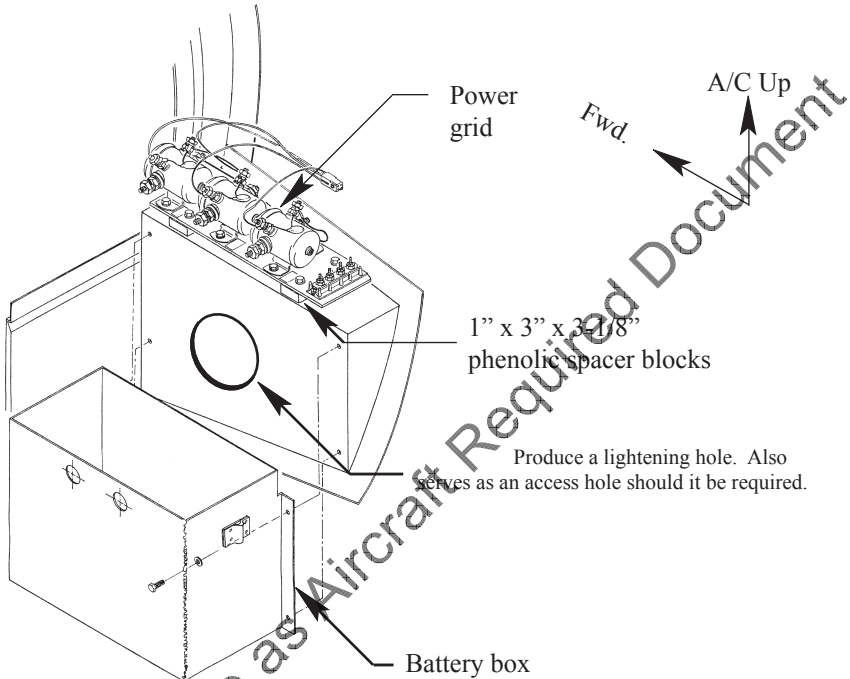


Hydraulic Powerpack

As with any hydraulic system proper servicing is required. Use only MIL-H-5606 “red” hydraulic fluid, and remember that with hydraulics, cleanliness is next to godliness.

“Original” Hydraulic Power Pack Installation

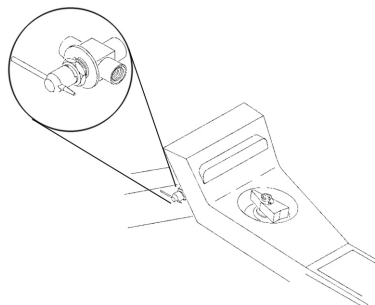
Fig. 2



A valve is provided to connect the high and low pressure lines essentially equalizing the system pressure. The main gear will then free fall of its own weight and the nose wheel gas strut will drive the nose wheel down. This “gear dump” valve is located left side by the pilot’s right knee.

Note:

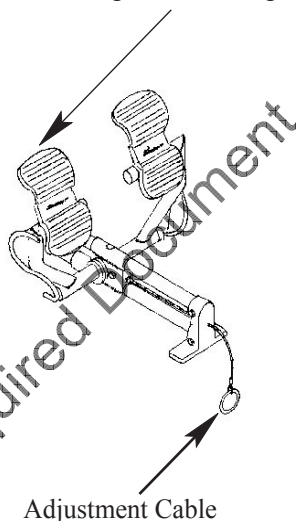
This valve is located by the pilot’s right knee. Its operation should be checked periodically.



BRAKE SYSTEM

The Legacy brake system is standard on the pilot's (left) side. Steering on the ground is by use of differential brakes. The rudder pedals incorporate independent toe brakes. The optional adjustable rudder pedals shown to the right allow adjustments to the pedal position. By pulling the adjustment cable a lock disengages allowing the assembly to slide to the desired position. To adjust the mechanism aft simply pull the cable to disengage the lock and into the desired position. Push of the pedal to assure that the mechanism is locked in place. To adjust forward, pull the cable to disengage the lock and push forward with your feet preferably as low as possible on the pedal.

Use the toe brakes
for ground steering



Brakes should be checked each time you leave the ramp prior to taxiing. Care should be used to not ride the brakes unnecessarily by using only sufficient power to maintain taxi speed. Also, you should get in the habit of checking your brakes on downwind before landing. To do so, simply depress each pedal to verify a "firm" pedal. Your initial flights in the Lancair like any new aircraft will require extra caution until you become familiar with the aircraft.

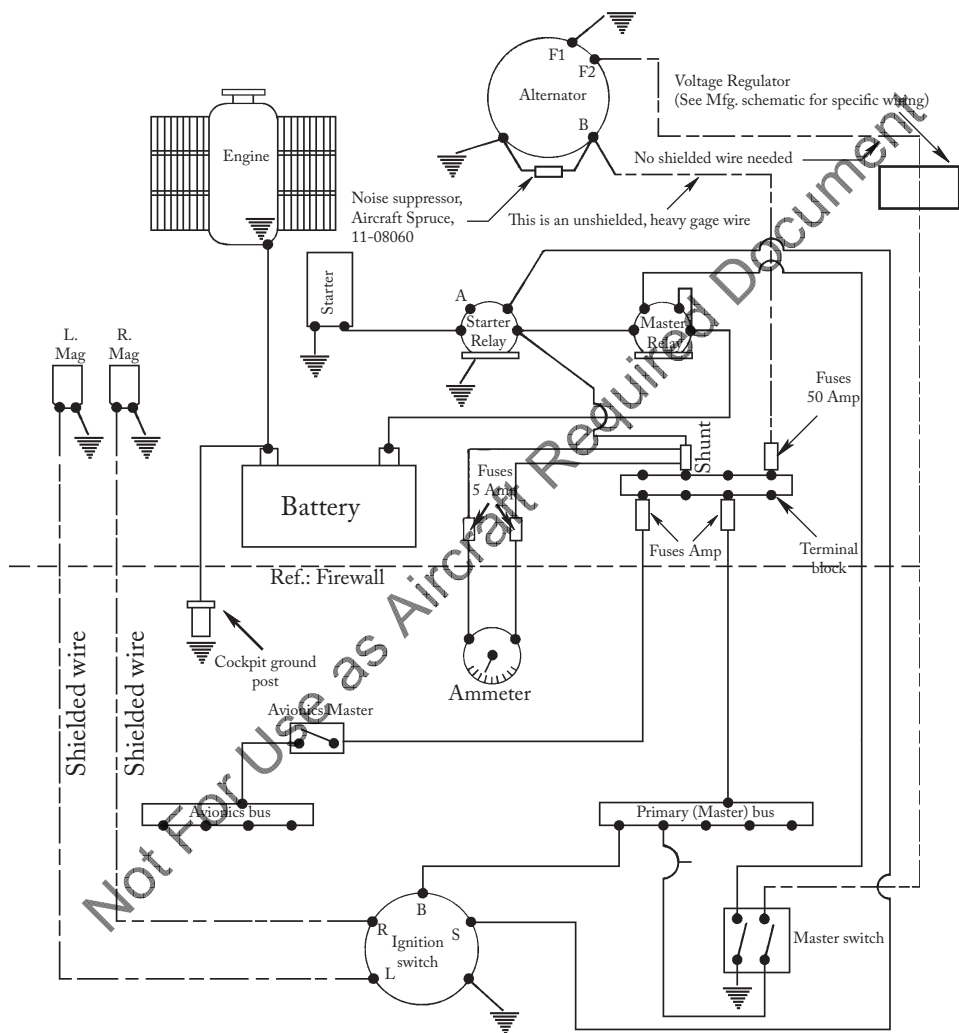
A brake reservoir is located on the firewall. The brake system should be bled on a regular basis to ensure a sufficient amount of fluid.

ELECTRICAL SYSTEM

The Lancair basic electrical system consists of an alternator, a voltage regulator and a battery. This is shown in the figure next page. The alternator provides power to the main electrical buss and the battery. The recommended configuration is with an avionics buss separately controlled by an avionics master switch. From this main buss, power is supplied to the flap motor, the hydraulic pump motor and the lights. The magneto circuits are independent of the electrical system and each other.

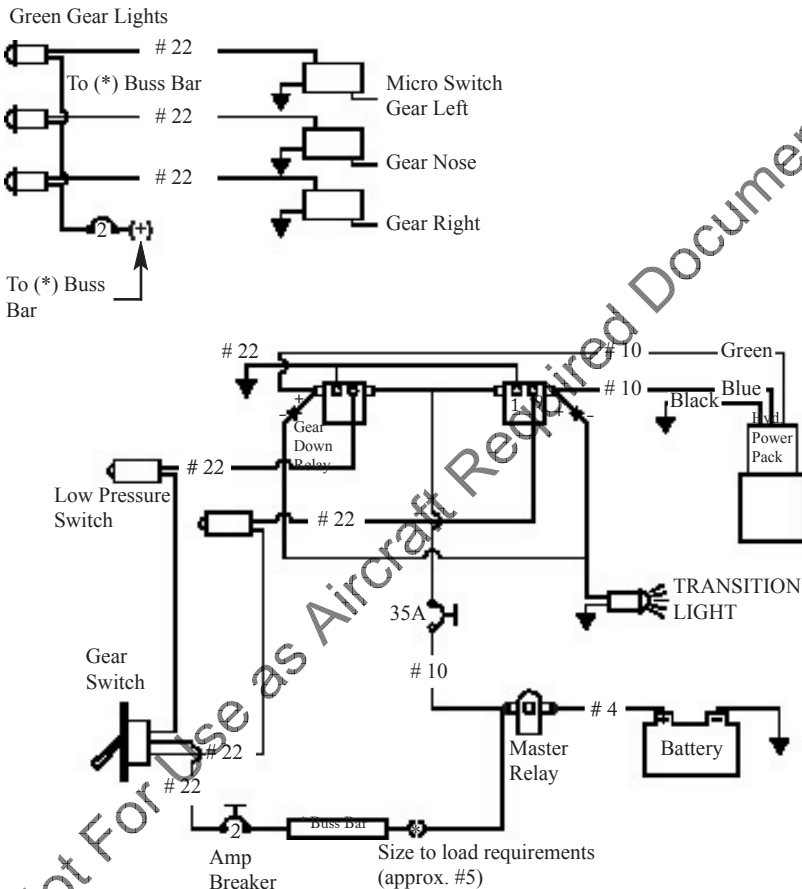
Since the Lancair is a composite design, all circuits require the use of a return wire leading to "ground". The use of a ground buss is recommended with it being located near the firewall requiring only one relatively large ground wire to the battery and one "hot" wire to the starter. The power to the starter is controlled by a relay.

Basic Electrical Schematic



The Landing Gear Electrical Schematic for the hydraulic system is shown. As can be seen the green gear (down) lights are independent of this system, only shown here for completeness. The power pack is powered thru relays with pressure switches to cut power to the pump when the pressure is achieved.

Landing Gear Electrical



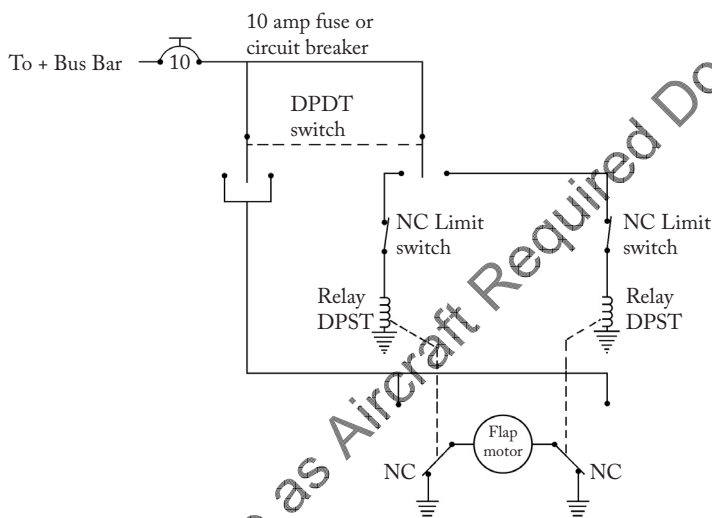
The hydraulic schematic is shown under the heading of the hydraulic system in this section. Together they show the simplicity of the landing gear system.

Flap Electrical System

The wing flaps are electrically operated and off of the main electrical buss. The linear actuator (essentially a two-way electric motor driving a jack screw) is located behind the pilot's seat. Attached to the actuator shaft is the limit switch assembly with the full up and down limit switches. These determine the extreme flap positions. Partial flaps are obtained by simply timing the actuation of the

switch. For example the “count” of 5 will generally result in approach flaps. If desired a mark can be placed on the extended flap visible to the pilot to aid in reaching a consistent position quicker. The simplicity of the system is apparent in the schematic shown.

Flap Motor Wiring Schematic



Aircraft Lighting

The variability of owner-built aircraft results in unique systems. Such circuits would include map lights, landing lights, instrument panel lights, position lights and strobe lights. Each would be powered off the main buss, have an appropriately sized circuit breaker, have their own switch (or rheostat) and as was indicated earlier their own ground return wire required by the composite material of the Lancair.

The avionics are operated off a separately powered avionics buss to allow the whole set of equipment to be turned off and on at one time. Their lighting systems are integral and with this configuration it is possible to leave on only one comm or one nav should an electrical failure occur in flight making the most effective use of the remaining battery power.

NOTE

It is recommended that the avionics buss be “cold” during engine starts to preclude any electrical surge from affecting the avionics suite.

HEATING, VENTILATING & DEFROSTING

Cockpit heating is provided by fresh intake air which is routed through a heat exchanger which is heated by the exhaust gases. A simple valve routes the air either overboard or into the cabin. Since the toxic exhaust gases are high pressure, they can leak into the fresh air side of the exchanger. It is imperative that this system be checked regularly to preclude introduction of these exhaust gases into the cabin. These gases contain carbon monoxide which significantly reduces the blood's ability to carry O₂, which seriously degrades judgment, night vision, etc.

Defrosting is accomplished by routing some or all of the warmed air to the windshield if the warm air plumbing is equipped with this arrangement.

Ventilation is obtained from two flush mounted air intake scoops which direct the outside air into the cockpit, one on each side wall. During ground operation the canopy can be left partially open until takeoff. The canopy can never be opened in flight, the latches must remain locked.

PITOT STATIC SYSTEM

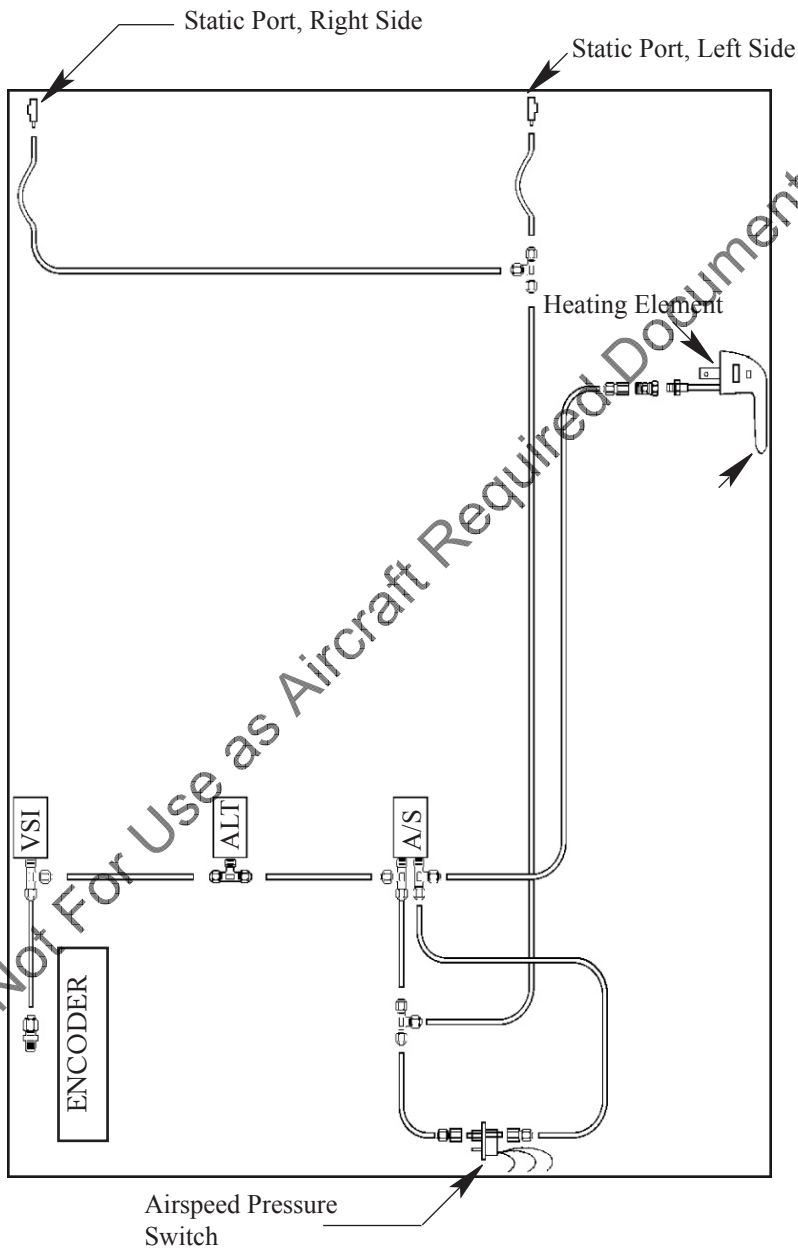
An electrically heated pitot tube is standard for the Lancair Legacy. They are typically located on the lower side of the left wing. If your flights have the potential of below freezing temperatures, IMC conditions or precipitation the pitot tube should be checked prior to each flight.

This check can be made during preflight by turning the master switch on, the pilot heater power on for a few seconds (less than 10 typically) and then feeling the probe for warmth. The preflight should also check that the probe opening has not become home for a wasp and that any cover has been removed.

NOTE

Probe heater power can never be left on except in flight. Over heating and loss of the element will occur.

Pitot Static System



Your aircraft may have one or two static ports. The static ports are installed underneath the aft windows. During pre-flight you should inspect the static port especially if the aircraft has been parked outside.

VACUUM SYSTEM

The vacuum system is powered by a vacuum pump driven by the engine. Its operation is vital to many gyro instruments and is indicated by a pressure gauge. The gauge can be one which indicates the pressure value or a small indicator with a red or green flag. Either is acceptable, however the gauge may provide an indication of gradually decreasing pump capability and thus provide some warning of failure

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NOTES:

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NOTES:

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HANDLING, SERVICING AND MAINTENANCE

SECTION VIII

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INTRODUCTION TO SERVICING

This section is designed to help you the owner and pilot of your Lancair to service and maintain it in a safe and efficient manner. The information herein is approved by Lancair International. The intended user of this handbook is the pilot, not the aircraft's mechanic. The information herein is intended as a guide to maintaining the aircraft and assumes any fall work accomplished is of such quality that structural or aerodynamic integrity is not compromised. Inspections, inspection periods and servicing information herein should be used as a guide.

“51% Rule”

Your Lancair is in a growing group of aircraft called amateur built. This group of aircraft is unique in that, under the proper conditions, you the builder can become that aircraft's “Certified Repairman” under the Federal Aviation Agency rule that states that the applicant must have built the majority of the aircraft, thus the so called “51 % Rule”. This has many far-reaching advantages which allow you the builder to service, alter, and maintain that aircraft throughout its “life”. This obviously has many advantages and is probably part of the reason you purchased the aircraft.

“51%” Documentation Requirements

As you build your aircraft it is important that you keep a good record of your construction. Keeping a record of all the parts purchased is important as well as a photo album. Pictures of you in the process of building are considered mandatory by some agency personnel and the more pictures the better. Be sure to date each photo or section, adding some ID as to which part of the construction manual is being worked on. Finally, a notebook logging of your building process is recommended. This log should contain your day-by-day description of work performed. Reference to the construction manual section should be included and the pictures posted in the log is ideal. Each day's entry should be initialed or signed just as a pilot's log book is endorsed by the pilot

Given this documentation you should have no problem obtaining your “Repairman” certificate. With this certificate you then are in effect the A&P and the AI for your aircraft (plus engine and propeller) and can perform any and all maintenance it may require, modify, add or remove equipment, etc. with the resulting savings in both time and dollars.

WARNING

It remains your responsibility as pilot to insure that the machine remains airworthy. For example your altimeter and static system must be checked each 24 months by a certified repair station before the plane can be flown in the IFR system. The transponder and encoder must be certified every 24 months for VFR or IFR flight.

All limits, procedures, safety practices, servicing instructions and requirements contained in this handbook are considered by Lancair to be mandatory. It is strongly recommended that you secure the services of an FBO familiar with Lancairs or at least this type of amateur built aircraft for support. This will benefit both you as the owner and the FBO by becoming your second pair of eyes on an as required basis. Your local EAA chapter can supply you with helpful information in this regard.

Non-owner Built Aircraft

If you purchased your Lancair from the builder, it then falls under the rules of all other aircraft and owner/pilot maintenance is significantly restricted. It is then treated just as a commercially built aircraft except that an AI is not required for annuals, and A&P can perform annuals on an "amateur built" aircraft. (The original builder still may perform any and all work on your aircraft, the one he built, however.)

For aircraft registered in the United States, FAR Part 43 defines the types of servicing and maintenance that a certified pilot who owns or operates the aircraft may perform. For other countries the registry of that country should be consulted to define the work that may be performed by the pilot. All other maintenance required must be performed by appropriately licensed personnel.

In this case it is again recommended that you secure the services of an FBO for your maintenance so that it can become familiar with the aircraft. Such personnel will undoubtedly want to familiarize themselves with the aircraft and will need access to the builder's manuals, blueprints, etc. in order to best serve your needs.

AIRPLANE INSPECTION PERIODS

FAA Required Inspection Periods

An annual condition inspection is required on all aircraft. This inspection must

include an inspection of the landing gear, all structure for cracks, evidence of delaminations, corrosion of parts, security of fittings and fasteners, a compression test of the engine's cylinders, and an inspection of the propeller. This "Condition Inspection" must be signed off in the aircraft log book by the inspector as well as any repairs necessary due to items found during the inspection.

Recommended Inspections

It is recommended that two additional levels of inspections beyond the preflight inspection found in Section IV of this handbook be made. These are at 25 hour and 100 hour intervals. Your new aircraft will undoubtedly be given several "100 hour" inspections at earlier intervals, a practice which is also recommended. In addition there are continuing care items, items which have a recommended overhaul or replacement schedule, and special inspections required due, such as gear or flap extensions at high speeds.

The 25 hour inspection is intended to cover rather routine items of wear such as tires, oil changes, cable end fittings, brake linings, hose and wire fretting and rubbing areas, etc.

The 100 hour inspection takes a more in-depth look at the aircraft for structural cracks, delaminations, etc. much as an annual inspection. It is recommended that the aircraft be thoroughly washed, the engine cleaned, compression checked and a complete review of the aircraft and engine log book be made to insure all FAA (or appropriate registering agency) requirements for such items as altimeter checks, item TBOs, etc. This inspection must be recorded in the aircraft and engine log books and signed by the inspector. Since your aircraft is registered as an EXPERIMENTAL aircraft it cannot be used for hire, however for aircraft flown regularly, accumulating many hours through the year this is a recommended inspection.

ALTERATIONS OR REPAIRS

If you built your aircraft and have received your "Repairman" certification, you may make any modifications desired however in the interest of safety we strongly recommend that you seek experienced consultation before making any modifications to your Lancair. We take pride in your Lancair as well and have your best interest at heart. If you purchased your aircraft, your local FAA inspector may be interested if you make any alterations. They may contact Lancair or its dealers for advice. In any case, the work must be performed by properly licensed personnel.

NOTE

Only Lancair or its dealers approved parts should be used for any repairs to your Lancair. Salvage parts, or parts whose history cannot be fully traced and their care in storage and handling completely defined and determined acceptable by Lancair or its dealers are not acceptable and are considered unsafe for use.

GROUND HANDLING

The three view drawing shows the dimensions of your Lancair and its hangar requirements on page I-6.

CAUTION

Proper inflation of the air/oil oleo style nose strut should be maintained to insure adequate propeller clearance and operation. In addition while ground handling your Lancair the propeller should be placed in the horizontal position. Use care when turning the propeller. **ASSUME THE MAGNETOS ARE HOT!**

Towing

Your Lancair is an exceptionally light aircraft and should present no problems while ground handling. Mechanically attached towing is generally not recommended. If mechanical towing is necessary a tow bar fitting in the nose wheel axle should be used and extreme care taken. Hand towing is recommended as are wing walkers when towing in confined spaces.

CAUTION

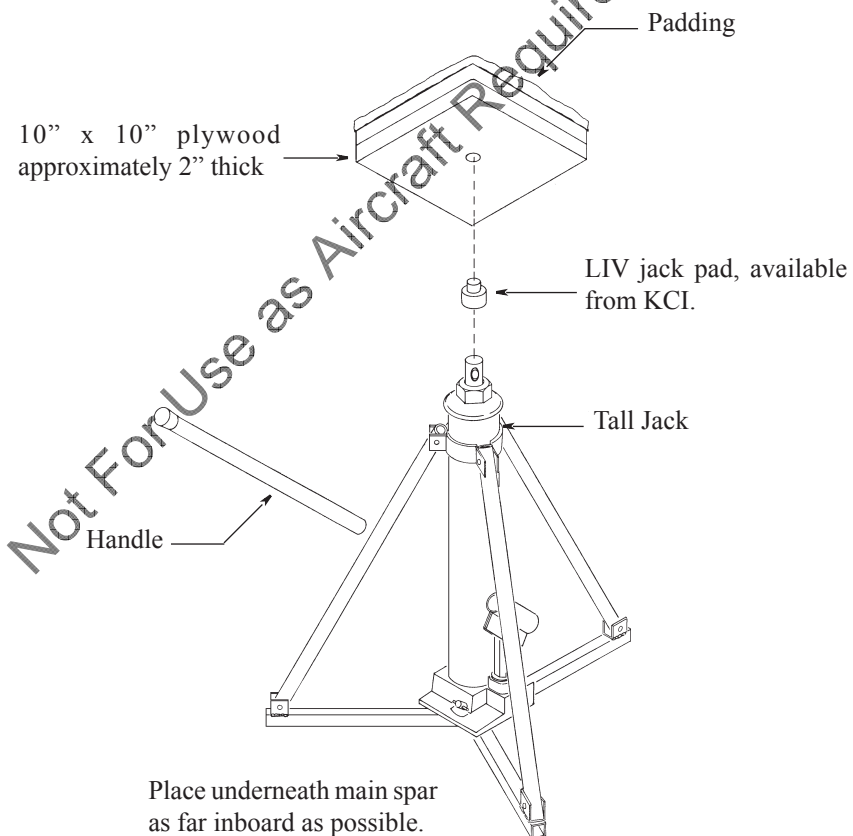
Do not exert force on the propeller or control surfaces during towing by hand. If the nose wheel must be raised, apply weight on the fuselage forward of the empennage, not on the horizontal stabilizer. With the nose wheel off the ground, the aircraft can be pivoted around the main gear as required.

Tie-downs

The Legacy has removable tie-downs which are removed for flight. The tie-downs should be used to secure your aircraft unless it is hangared. Tie-down ropes should be left with some slack to allow for any rope shrinkage. Manila or hemp ropes should not be used. Chains can be essentially snug. Chocks for the main gear wheels are also recommended.

MAIN WHEEL JACKING

As of today, Lancair does not have a recommended hardpoints for jacks for the Legacy. However, the following method works well:



NOTE

When it is necessary to raise the entire aircraft in order to perform the retract test, you will need one jack underneath each wing. Remove the upper cowling and attach the engine hoist to raise the engine.

CAUTION

Anytime an aircraft is on jacks of any sort personnel should not be allowed in or on the aircraft.

NOSE WHEEL JACKING

The nose wheel may be raised easily by securing some weight about the fuselage forward of the empennage. A 4 inch wide strap is recommended or the use of the tail tie down point. Approximately 150 pounds is required. Again care must be observed and the caution note above applies.

OUT-OF-SERVICE CARE

Should you be required to place your Lancair in storage precautions to protect it from deterioration are recommended. If long term storage is required protection from the elements is the primary concern. With the Lancair it may be easiest to remove the wings and store in your garage where you have (or can provide) some control over temperature and humidity. In any case the most susceptible element of your aircraft is the engine's cylinder walls and bearing surfaces. The engine should be preserved according to the manufacturer's directions.

The airframe will withstand the storage quite well under almost any circumstances since it is of high temperature materials however the upholstery, instruments and avionics will suffer from excessive heat and exposure to the sun so a cover is recommended. Elastomers such as tires also need to be protected from exposure to ultraviolet to limit their deterioration.

Fuel tanks should be filled or drained completely, the control surfaces locked, the aircraft electrically grounded, a pitot cover installed, the static port (or ports if installed on both sides) covered, the engine and cabin cooling air intake (NACA inlets) covered or plugged, and the battery removed.

Flyable Storage

If the aircraft is to be put into flyable storage, the engine would not be preserved nor the dessicated plugs installed. Once a week the engine should be rotated by hand some 4 to 6 revolutions, and left in a different position.

WARNING

Before rotating the propeller make sure the mag switches are OFF, the throttle closed, and the mixture control in the CUT-OFF position. When turning the propeller assume it may start by standing clear.

Each month, the aircraft should be started and run. It is preferable to fly the aircraft for thirty (30) minutes as the Lancair engine compartment is tight and inadequate cooling may result from a ground run.

PREPARATION FOR SERVICE

Following storage, the aircraft preparations for flight should include the following. Remove all taped openings, plugs and control locks. Clean and thoroughly inspect the aircraft checking the gear, tires, controls pitot and static ports. Install a serviced battery. Install spark plugs and check the oil level. The oil used for storage should be removed and proper oil installed. The fuel tanks should be checked for water accumulation and purged as required. Following a short but thorough engine ground check the aircraft should be flown for 30 minutes maximum and given a very thorough post flight inspection.

FUEL SERVICING

The Lancair fuel requirements are dependent on the engine installed. The engine manual should be checked for the recommended grade. In any case, the fuel should be clean and water free. The firewall gascolator drain should be checked on preflight inspections for evidence of water and the filter checked for solid foreign material. It is good practice to leave the tanks full to minimize the amount of combustible fuel/air vapor present in the tanks. This also helps minimize the amount of water vapor in the fuel system.

OIL SYSTEM SERVICING

The oil used should conform to the engine manufacturer's recommendation. Since engine oil consumption is higher during break-in of a new or overhauled engine, very long flights should be avoided until it is certain that the sump quantity is

sufficient for the flight duration. The oil level is checked thru the small door on the upper right top side of the engine cowling. A minimum of 6 quarts should be indicated before every flight.

Oil Changes

During the initial break-in the engine should be operated with a straight mineral oil. The break-in is normally 25 to 50 hours during which time the oil consumption should stabilize. Following this break-in period, the oil and filter should be changed and an oil Ashless Dispersant Oil installed. If consumption has not stabilized at the 25 to 50 hour point, continue the use of mineral oil.

The engine oil should be changed at a minimum of each 50 hour of flight time. More often is recommended. The engine oil should be drained while the engine is thoroughly warm and with the aircraft in a level position. The filter should be changed at each oil change and the element examined for its contents. If a "spin-on" filter is installed it should be cut open and the element examined. Sand type material is indicative of inadequate air filtration and may warrant corrective action ranging from more frequent changes to the installation of an improved filter system. Metallic particles may vary from aluminum to steel to stainless steel. Following the initial break-in period during which some metallic particles are normal almost any amount there-after becomes cause for concern. If subsequent changes show additional metallic particles, the source should be determined. The type can be somewhat determined by separating by category, i.e. magnetic or not, steel or aluminum, silicon (sand), etc.

Another method of determining the source is the use of spectral analysis of an oil sample. These services are readily available by mail, and can provide you with a running history of the contaminants from each of your oil changes.

BATTERY

The battery should be checked for electrolyte level at each 25 hour inspection and serviced as necessary with distilled water. Do not overfill, nor should the battery be serviced in a low or discharged condition. If the battery is low on charge, service to cover the plates, charge to full, then service to full. Full is generally indicated by a "service ring" within each cell of the battery about an inch from the top.

Excessive water consumption may be an indication of an improperly set voltage regulator. The fully serviced and charged electrolyte should be checked for specific gravity.

Warning

The battery box is vented overboard to dispose of the hydrogen gas produced during charging. Hydrogen is an explosive gas in widely varying concentrations so it is important to frequently check that the vent line is clear of obstructions.

TIRES

The tires should be properly inflated at all times. The nose wheel tire should contain 30 to 35 psi and the main gear tires from 50-60 psi. Maintaining the proper inflation will minimize tread wear and aid in ground control of the aircraft. When inflating, visually check both sides of the tire for bulges, cracking of the sidewall, cuts. The tread should be greater than 1/16".

WARNING

Tire size is important on your Lancair. Use only the specified tire. Other sizes will not fit into the wheel well and may damage the mechanism and the aircraft structure.

LANDING GEAR SHOCK ABSORBERS

Visually inspect the oleo struts for any signs of leakage. A leak may also be internal in the strut so also inspect the bottom of shaft for any residue through the hole of the fork.

The struts contain air (nitrogen) and oil and are a sealed system. The nose wheel strut contains a shimmy dampening system which must be checked often. This check is made as follows:

- 1) Have someone hold the nose wheel off the ground by pressing down on the fuselage just forward of the empennage.
- 2) Spin the nosewheel. It should not spin over one or two turns at the most. If excessive rotation occurs the axle nut must be retightened and the test conducted again until satisfactory. Verify that the Timken bearings are properly snug, there must be no free play between bearings and race. Check that the side bushings are properly snugging against bearings and that they are not worn.

The shimmy damper system should provide 20 to 50 ft-lbs of drag when the wheel/strut is moved (rotated left and right about the strut axis) at a moderate rate. Fast rotation rates should create higher torques. Verify this condition. Lift the nose by an engine hoist or have someone hold the tail down.

It is a good idea to wipe the exposed strut shafts clean with a cotton cloth lightly dampened with mineral oil every few flights.

BRAKES

The brakes are independent systems on each of the main gear wheels. The fluid reservoir for each is located behind the rudder pedals on the pilot's side. The toe brakes should depress approximately 1/2 inch before any pressure is generated on the brake when properly serviced. Lines should be checked for leaks and chaffing due to rubbing on the tire or the airframe while the gear is retracted. The brake pucks should be a minimum of 0.150 inches thick. The brake pucks should be replaced when less than this value.

INDUCTION AIR FILTER

Operation of the aircraft in dusty areas requires that a filter be installed and changed periodically to preclude premature engine degradation. Removal of the filter requires removal of the cowlings and should be accomplished at least on an annual basis. If operating in dusty areas, more often is desirable. Depending on the type of filter used, it may be cleaned, or may require replacement.

INSTRUMENT VACUUM SYSTEM

The vacuum (or pressure) system for use by the gyro instruments contains very fine particle filters. These require changing on a regular basis. If operating the aircraft in a normal environment the filters should be changed every 500 hours or three years, more often in dusty areas.

PROPELLER

Your propeller should be serviced according to the manufacturer's instructions. It is a highly stressed component and any failure has the potential of being catastrophic. Treat it with care. Nicks and dents (stress risers) in the leading edge due to rocks,

hail or whatever need to be “dressed out” until smooth. Care should be used to maintain a similar contour to the blade after dressing and the area should then be polished resulting in a smooth, scratch free surface.

WARNING

Use care when handling the propeller. Insure that the mags are OFF, the throttle CLOSED, and the mixture in the CUT-OFF position. Then remain as clear as possible during the dressing operation. Be prepared for a cylinder to fire when moving the propeller to a new position.

ELECTRICAL POWER

Alternator

The alternator is an alternating current device which is then converted by diodes to direct current for charging the battery. It has no brushes or other rubbing parts and may have the voltage regulator mounted on the unit or integral. The alternator units offered through KCI Aviation use a remotely mounted voltage regulator. Its d.c. voltage output should be the same i.e. 14.2 to 14.8 volts. An alternator should never be operated open circuit, that is without a load.

The Lancair uses a negative ground system. Filters in the system reduce noise in the avionics from the alternator (and the magnetos).

Excessively high voltage regulation will cause overcharging of the battery and shorten its life, low settings will result in a low battery and probably poor starting especially in colder weather.

CARE AND CLEANING

Your Lancair requires no special care and cleaning. Prior to washing, cover the wheels, pitot and static ports, and plug cabin air intake ports. Care should be used to avoid removal of grease and oil from lubricated areas.

The windshield should be cleaned with generous amounts of water and a soft cloth. Prepared cleaners should be used with caution unless expressly made for acrylic material. Oil and grease can be removed with small amounts of kerosene if necessary followed by soap and water.

Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, anti-ice fluids, lacquer thinners or glass cleaners. They will either soften the material or cause it to craze. Rubbing of the surface with a dry cloth should be avoided as it causes static electricity build-up which subsequently attracts dirt and dust particles.

Upholstery materials and carpets can be cleaned in the normal manner. Rubber seals can be lubricated with Oakite 6, Armorall or equivalent materials. A vacuum is the primary means of cleaning the interior of loose dust and dirt. Blot up any liquid spills as soon as possible with cleansing tissues or clean rags. Hold the material securely against the spill for a few seconds allowing it to absorb the liquid. Repeat until all liquid is removed. Scrape off any gum materials. Test a spot remover on a test piece of material or an out of sight location if there is any question as to the compatibility of the cleaner and the upholstery or carpet materials. If acceptable, clean areas of spots as necessary. Detergent foams can be used to clean carpets if used per the manufacturer's instructions.

Interior plastic parts should be cleaned with a water damp cloth. Oil and grease can be removed with cloth dampened slightly with kerosene. Volatile solvents such as those mentioned for the windshield are to be avoided.

Exterior Painted Surfaces

CAUTION

Polyester urethane finishes cure for 30 days or more following application. They should be washed only with a mild non-detergent soap until cured. Use only soft clean cloths and mini-mize rubbing to avoid damage to the paint film surface. Rinse thoroughly with clear water. Stubborn oil or grease deposits may be removed with automotive tar removers if required. (Mild detergents can be used on Urethane finishes.)

Wax or polish paint only after it has completely cured. Use power polishers with extreme care as they can build up excessive heat levels locally at the polishing surface and damage the paint surface.

CAUTION

Avoid the use of high pressure cleaning systems and solvents. They can damage parts such as propeller hubs, fill pitot probes and static ports, enter cooling air ports with resultant damage to the interior and avionics, and remove areas of required lubricants. This type of equipment is great for DC-8s, not Lancairs.

ENGINE

Clean the engine with a neutral solvent. While the engine is warm but not hot, spray with the solvent and allow to set a few minutes. Follow with a spray wash and allow to dry. Avoid excessively high pressures which can force entry of water and/or solvents under seals resulting in contamination of the sealed system or entry thru the firewall into the cabin. Use caution and protect any electrical relays or switches you may have installed in the engine compartment as well. Use only solvents which do not attack rubber or plastics.

RECOMMENDED SERVICING

INTERVAL

ITEM

Preflight

Check & Service oil
Drain water trap
Service fuel tanks

First 25 hrs

Service oil with Ashless dispersant oil
Change oil filter
Change fuel filters
Check battery fluid
Check brake lines
Check all gear doors (nose & main gears)
Check wing bolt torque
Control surface hinges

First 50 Hrs

Change oil and filter
Clean or change engine air filter
Lube landing gear mechanism
Check control surface hinges

Lancair Legacy

ANNUAL TYPE CONDITION INSPECTION

Model: _____ Serial Number _____ Registration Number _____

Tachometer Time _____ Total Time _____ Date _____

CHECK LIST		Initials
ENGINE		
1. Check documentation: AD's, SB's, SDR's, ARROW etc.		
2. Fuel Pressure (boost pump) _____ psi		
3. Start-up oil pressure _____ psi		
4. Run engine @ 1200 RPM until oil temp reaches 140°F		
5. Idle oil pressure _____ psi		
6. Magneto check: DROP L/H _____ R/H _____ @1700 RPM		
7. Cycle prop & check prop governor operation		
8. Suction _____ Inches of Hg (4-6 normal)		
9. Alternator output check for normal		
10. Full power manifold pressure _____ Hg @ _____ RPM		
11. Check for general running conditions & vibrations		
12. Check idle speed & mixture _____ rise @ _____ RPM		
13. Magneto ground check		
14. Compression check: #1 _____ /80; #2 _____ /80; #3 _____ /80		
_____ #4 _____ /80; #5 _____ /80; #6 _____ /80		
15. Drain engine oil		
16. Remove oil filter & or screen. Check for contaminants		
17. Drain engine breather can if installed. Check whistle for dirt		
18. Install new oil filter & or screen gasket. Service engine with recommended quantity of oil		
19. Clean & gap spark plugs. Rotate plugs top to bottom		
20. Check ignition harness for chaffing & general condition.		

21. Check condition of magneto points, set / replace as necessary. Rebuild every 500 hrs	
22. Check magneto to engine timing in accordance with engine data plate	
23. Check exhaust system for cracks, security, & condition of gaskets	
24. Check intake pipes for condition & leaks	
25. Check condition of air box, clean or replace air filter element as necessary	
26. Check condition of alternate air system & flapper valves	
27. Check engine baffles & cowling for general condition	
28. Inspect fuel hoses for general condition	
29. Clean injector nozzles	
30. Replace or clean fuel filter & screens as necessary	
31. Check engine vibration isolators for poor condition & deterioration	
32. Check engine mount for cracks & security to firewall	
33. Check engine for oil leaks	
34. Check prop governor for leaks, security, & condition of cable end	
35. Check starter for security & condition	
36. Check alternator & mount for security, condition of wiring and belt for condition and tension	
37. Check vacuum pump for security & condition	
38. Check tach cable or wiring for security & condition	
39. Wash engine. CAUTION: DO NOT CONTAMINATE VACUUM PUMP or INDUCTION SYSTEM WITH FLOOD.	
40. Lubricate engine controls and check for connections & travel	
PROPELLER	
1. Inspect propeller for cracks, nicks, binds & oil or grease leaks	
2. Remove minor nicks & dress blades as necessary	
3. Check propeller mounting bolts for torque & safety wiring	
4. Check blades for looseness in hub	
5. Inspect spinner, screws & bulkhead for cracks & condition	
6. Lubricate propeller per manufacturer's recommendation	
CABIN	
1. Check seat belts for general condition & defects.	
2. Check battery for electrolyte level, S.G. and charge	
3. Check battery vent for security & obstructions	
4. Clean battery cable terminals if required & reinstall battery	

5. Check hydraulic power pack & lines for leaks, security, & fluid level	
6. Check elevator idler arm for security & lubricate rod ends	
7. Inspect flap motor compartment, rods and motor for proper operation, running current & lubricate	
8. Check aileron, elevator push tubes, trim systems & lubricate rod ends	
9. Check for loose equipment that might fowl the controls	
10. Check composites for signs of delaminations, distortion, cracks, damage & lost paint or other evidence of failure	
11. Check canopy & hardware for general condition, operation & lubricate	
12. Inspect rudder cables & attachments etc.	
13. Inspect brake master cylinders & parking brake valve for leakage, free & full extension & proper operation. Check fluid level at the master cylinders	
14. Check condition of instrument panel, wire, hoses, & vacuum filters	
15. Check compass for fluid level & correction card	
16. Check instrument lights	
17. Check instruments for proper markings, general condition & security	
18. Clean inside of cabin & insure that drain holes are clear	
19. Inspect fuel lines & tank for security & leaks.	
20. Inspect pitot static lines	
WING	
1. Remove inspection covers	
2. Inspection & lubricate all bell cranks, push rods, & end rods	
3. Check all wing attach bolts for security & operation	
4. Check flaps for general condition & operation	
5. Check flap actuating rods, bell cranks, hinges, & bearings condition and lubricate	
6. Check pitot mast & lines for security & obstructions	
7. Check ailerons for condition & hinges for wear, lubricate	
8. Install inspection covers	
ELECTRICAL	
1. Check navigation lights	
2. Check landing & taxi lights	
3. Check strobes for proper operation & security	
4. Check cockpit & instrument lights	
5. Check pitot heat	
6. Check ELT for operation & battery due date	

RADIO

1. Check radio & electronic equip. for proper installation & secure mounting
2. Check wiring & conduits for proper mounting & obvious defects
3. Check bonding & shielding for improper installation & condition
4. Check antennas for condition, secure mounting & proper operation

FUEL SYSTEM

1. Check fuel transfer pumps for operation
2. Check fuel tank filters & sump drains for contaminants
3. Check all fuel vents for security & obstructions
4. Check fuel lines for security, chaffing & leakage
5. Check fuel tanks & caps for leakage, security and placards
6. Check fuel boost pump for operation, leaks, & security
7. Check fuel shut-off valve for operation & leakage

LANDING GEAR

1. Place aircraft on jacks
2. Clean excess grease off gear legs, struts, & wheels
3. Check brake discs & linings for wear or cracks
4. Check wheels for general condition & cracks
5. Check tires for wear, condition & proper inflation
6. Check wheel bearings for corrosion & wear. Repack w/grease
7. Check main gear trailing beams & bolts for wear
8. Check main gear weldment for fore & aft end play
9. Check compression assemblies & bolts for wear (disassembly required)
10. Check nose gear drag link at the knee for wear or hole elongation (disassembly required)
11. Check nose gear gas spring for 100# min. to compress
12. Retract the gear checking for wear and freedom of movement of all bearings of gear & drag strut assembly. Lube all moving points. Check pressure within limits
13. Check gear doors for fit & security. Lubricate pivot points & rods
14. Free fall the gear using the dump valve. Check for freedom of movement & over centering links. Check gear using power pack & check pressure down within limits
15. Check nose oleo shimmy damper for proper resistance to movement
16. Check nose gear oleo for condition & leakage. Inflate nose gear oleo to specified psi unloaded or strut extension loaded

17. Check nose gear operation when wheel is at slight turning radius & tire or tang do not hang up when gear is retracted. Service oleo strut with fork fluid every 100 hrs	
18. Check operation of gear position lights & switches	
19. Check all gear actuators & sequence valves for proper operation & leakage	
20. Check gear switch is down & dump valve is closed. Remove aircraft from jacks	
EMPENNAGE	
1. Remove exterior inspection covers. Inspect for security & wear & lubricate torque tubes, cables & bell cranks. Reinstall inspection covers	
2. Inspect rudder hinges & rudder attachment pin & safetied	
3. Inspect trim tabs, elevator hinges & lubricate	
GENERAL	
1. Check all optional equipment for security & proper operation	
2. Check all placards	
3. Check composites for signs of delaminations, distortion, cracks, damage & lost paint or other evidence of failure	
4. Run up engine & check oil pressure & all gauges for proper operation	
5. Magneto check @ 1700 RPM L _____ RPM drop	
R _____ RPM drop	
6. Check operation of prop governor	
7. Check max M.P. & T.O. RPM	
8. Check idle speed & mixture	
9. All paper work properly signed and AD's & SB's compliance checked	
10. Inspect each installed miscellaneous item that is not otherwise covered by this listing for proper operation & installation. See FAR Part 43 Apendix D.	



NOTES:

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SUPPLEMENTS

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GENERAL

This Handbook is structured in accordance with the General Aviation Specification #1. Many areas of the format will, however, differ to the unique characteristic of your category of aircraft-Experimental/Amateur built, whereby certain equipment and performance data will vary significantly and must therefore be entered individually by you, the builder/manufacturer.

Handbooks prepared in accordance with this specification are approved by the FAA and the format is being followed by all “General Aviation” manufacturers with the goal that similar information will be in similar locations and formats for all aircraft in the interest of safety. Lancair is proud to be the first kit aircraft to follow this format. Whether you have constructed your aircraft or purchased it completed, this handbook should prove to be a valuable asset and complement to your Lancair.

Per the GAMA Specification, “This section of the POH shall contain the appropriate Supplements (operating information) necessary to safely and efficiently operate the airplane when equipped with the various optional systems and equipment not provided with the standard airplane.”

This section in your Handbook is intended to cover the systems or specific pieces of equipment you have installed in your Lancair. When a system or piece of equipment is installed, a Supplement should be installed in your Pilot’s Operating Handbook for reference at all times.

While we will identify those systems which we have as “options” for your Legacy. We encourage you to tailor your own Supplement for inclusion into this handbook for any special systems you may install in a similar manner. The discipline of doing this will repay you many times in the long run.

SCOPE

Each Supplement should cover only a single system or piece of equipment such as an autopilot, electric trim, or an area navigation system. Systems with multiple components (like a deicing system) may have a single Supplement or a Supplement for each component making up the system if each component is marketed separately and has its own approving authority such as the FAA. The effect of each component of its failure should be identified and “work-around” procedures identified.

SUPPLEMENT ISSUANCE

Supplements for Lancair “options” which you purchase will often be provided by Lancair or its dealer.

Supplements for systems or equipment which you install may be provided to you by the manufacturer, but you should be aware that such supplements are often not offered or available or not in a usable format, and thus the development of the Supplement becomes our responsibility as owner. We encourage you to accept this discipline and record keeping chore and “tailor” your handbook.

SUPPLEMENT IDENTIFICATION

Supplements have a recommended format, i.e. a Cover (or Title) page, with unique identification, date of issue (or revision), and name or title of certifying or approval authority. In other words, the supplement from an avionics company for example should include the above information.

If you develop the Supplement, you should include the same information, and you become the approval authority.

PAGE NUMBERING

Page numbering of each individual supplement should follow a consecutive numbering system such as 1 of 3, 2 of 3, or 1/6, 2/6, etc.

STRUCTURE OF SUPPLEMENTS

Once again, quoting the GAMA specification, “Each supplement shall be a self-contained, miniature Pilots Operating Handbook...as a minimum... and be included in the Pilots Operating Handbook at all times.”

Section 1-*General Information.* This should identify the purpose of the system or equipment, and who has “approved” the system.

Section 2-*Limitations.* This is meant to identify any changes to the aircraft operation as a result of the installation of the system or equipment, or if no changes result, so state.

Section 3-*Emergency Procedures.* These procedures, associated with the subject installation(s), should “be presented in a checklist form when order of action is essential to safety” and any changes to the aircraft’s basic Emergency Procedures should be identified. If there is no change, it should be so stated.

Section 4-*Normal Procedures.* Like the Emergency Procedures, these should be presented in a checklist form when the order of its action is essential to safety or normal operation of the system. If there is no change to

the aircraft's normal operation, so state.

Section 5-*Performance*. The effect of the subject system on the aircraft's normal procedures should be clearly identified and again if no change, so state.

YOUR SUPPLEMENTS

The intent of the preceding tutorial is to provide you with sufficient guidelines to create your own specific supplements if/as required. The result should provide you with a Pilots Operating Handbook equal to the best. Since it is your book for your airplane, it deserves no less.

The various blank forms on the next pages will assist you in formatting your own supplements.

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**Pilot's Operating Handbook
and
Airplane Flight Manual**

for

Lancair Model _____, N _____

Log of Supplements

Supplements must be in the airplane for flight operations when subject equipment is installed			
Part Number	Subject	Rev. No.	Date
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Supplement for the

(System or equipment)

General - *(Description & purpose of equipment)*

Limitations - *(Of equipment)*

Approved by _____

Date _____

Performance Data from N540L

Press. Alt. Feet	OAT deg. C	Man. Pres. Inches	Fuel Flow GPH	RPM	KIAS Knots	KTAS Knots	Fuel Economy Naut. MPG
6,500	15	24.6	15.5	2500	203	226	14.6
	15	24.6	14.9	2400	200	222	14.9
EGT Peaked	13	24.7	14	2300	197	218	15.6
at 1,462	11	21.8	12.8	2400	190	210	16.6
	11	22.2	12.3	2300	187	207	16.8
All #'s 50d rich	10	19.1	11.2	2400	175	194	17.3
	10	19.4	11	2300	175	194	17.6
	10	15.9	9.4	2400	155	172	18.3
	9	16.5	9.2	2300	153	169	18.4
	9	13.3	7.9	2400	137	152	19.2
	8	14	7.8	2300	134	148	19
8,500	10	22.7	14.2	2400	192	220	15.5
	10	22.7	13.6	2300	190	217	15.9
EGT Peaked	10	19.6	12	2400	177	203	16
at 1,440	9	20	11.5	2300	176	202	16.9
	8	16.2	10.1	2400	158	181	17.9
	9	16.9	9.8	2300	155	178	18.2
	8	14	8.5	2400	142	163	19.2
	8	14.3	8.3	2300	143	164	19.8
	8	15	8.2	2200	143	164	20
	8	15.3	8.1	2100	143	164	20.2
	8	16	8	2000	143	164	20.5
10,500	6	20.8	13.2	2400	186	220	16.6
	6	21.2	12.6	2300	182	215	17.1
EGT Peaked	6	18.9	11	2300	174	214	19.4
at 1,426	6	18.4	11.4	2400	176	216	18.9
	4	15.7	9.5	2400	155	183	19.3
	3	16	9.4	2300	152	179	19
	2	13.8	8.2	2400	146	172	21
	2	14.1	8.2	2300	141	166	20.2

Press. Alt. Feet	OAT deg. C	Man. Pres. Inches	Fuel Flow GPH	RPM	KIAS Knots	KTAS Knots	Fuel Economy Naut. MPG.
12,500	3	19.4	12.2	2400	179	217	17.8
	3	19.4	11.6	2300	176	214	18.4
	2	16.7	10.2	2400	158	194.5	17.1
EGT Peaked	1	16.7	9.7	2300	156	192	19.8
at 1,435	1	14.3	8.7	2400	147	179.6	20.6
	1	14.7	8.5	2300	145	177	20.8
14,500	0	17.6	11.5	2400	165	208	18.1
	0	17.9	11	2300	163	206	18.7
	-1	15.2	9.4	2400	146	185	19.7
EGT Peaked	-2	15.2	9.3	2300	146	185	19.9
at 1,392	-2	13.1	8.2	2400	135	171	20.9
	-3	13.5	8	2300	134	170	21.2
15,500	4	17.2	10.8	2400	160	208	19.2
	3	14.3	8.4	2400	142	185	21.8
	2	11.3	7.9	2400	135	176	22.3
16,500	2	16.5	10.2	2400	155	205	20.1
	2	15.2	9	2400	146	193	21.4
	2	13.8	8.1	2400	137	182	22.5
	2	12.8	7.5	2400	130	173	23
17,500	2	16	9.6	2400	150	202.2	21.1
	2	15	8.8	2400	146	197	22.4
	1	14	8.1	2400	140	189	23.3
	1	13.3	7.8	2400	135	182	23.3
	1	12.6	7.4	2400	130	176	23.8



Emergency Procedures:

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Emergency Procedures:

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Normal Procedures:

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Normal Procedures: (Continued)....

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Performance:

System Description:



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Date _____

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SAFETY INFORMATION

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HAPPY FLYING & KEEP IT SAFE

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INTRODUCTION

Your Lancair Legacy is an extremely high quality aircraft and one which will give years of service given the care a fine machine deserves. It, like most other pieces of equipment, will operate best under certain conditions, and can be dangerous in others. We have attempted to identify the latter in this manual, and now will offer some suggestions for the safe operation of this very high speed aircraft.

First, it will be to your benefit to become thoroughly familiar with this Handbook, and the Warnings and Cautions noted herein. These have been selected to highlight those areas of special concern to you as a Lancair Legacy pilot.

If you built the aircraft you are undoubtedly familiar with the aircraft and its systems and such of this Handbook's information will already be familiar to you. On the other hand, if you have purchased the machine from someone else, that same information can prove invaluable. This particular section however can be of benefit to all of us. As the old adage goes, we're never too old to learn. Much of this will undoubtedly be a refresher, and some suggestions may not be exactly to your preference. That does not mean either is wrong, as for example, cross-wind landings can be made from either a crab or slip approach.

Many FAA and other such documents cover the material covered herein. You are probably familiar with many of these. Where Lancair and its dealers have learned by experience, trial and error, or the "hard way", we will try to provide you with our "lessons learned". As we obtain feedback from this original issue from you, we will include that feedback, providing you with the benefit of what others have learned.

WARNING

The Lancair Legacy aircraft are very high performance vehicles. All safety precautions must be observed to reduce to the maximum extent possible injury to the pilot(s) or passengers. Improper operations or maintenance compromises the safety of all involved.

GENERAL

Knowledge, skill, judgment and experience go together to make up the truly good pilot.

Know your airplane and its systems. Not just how it works, or is supposed to work, but how healthy its systems are. To do that you need to watch it in action, which means track its performance from day to day, flight to flight. This will allow you to correct minor problems so they don't become major ones.

Skill results when you continuously set tougher and tougher standards for yourself as you operate the aircraft. Fly smoother today than you did yesterday. Be more precise on lift-off speed today and hold climb speed closer.

Predict your and your aircraft's performance and understand why you were not quite on the mark. Total fuel used on this trip, why were you two gallons off... How was your prediction of the enroute and destination weather as compared to the briefers? Why was it different?

Experience comes from a combination of all of the above when we are honest with ourselves and objective about the facts. Experience need not be expensive, but it does cost time. Time not measured in hours of time logged, but how well those hours are flown, how aware we are during those hours, how we understand the differences of this flight from the last one. Making each flight a learning experience will gather that precious experience much quicker.

First Flight

Prior to your first flight in your Lancair it is only prudent that you obtain some training "in type". You are encouraged to take advantage of this type of training which can be with another Lancair owner in his aircraft, or thru a program offered by Lancair or its dealer. For information on training/flight familiarization, call Lancair or its dealer. Your first flight should be safe, enjoyable and rewarding. Training is very good insurance.

Every time you fly, take advantage of the FAA services which are provided for your safety - weather briefings and flight plans. Plan your flight with these data and plan out alternatives if weather is any factor what-so-ever.

Preflight your aircraft as if it is a game. Someone has deliberately introduced a fault into the aircraft, try to find it. If you make your preflight without a checklist in hand, go over the checklist in the cockpit to see if you checked each item. Once in the cockpit use your checklist religiously. Was the fuel level correct for both wing tanks? Is it adequate for the trip intended. Always keep the header tank at

1/2 or more. Baggage (secured of course) is not excessive such that gross weight or CG is out of limits? Mentally review the flight from take off thru landing for speeds and altitudes. Rotate at ___ kts, climb at ___ kts, level off at xxx feet, etc. First fuel transfer at ____, then ____, and so forth. With transfer pump failure at 3rd transfer what is course of action? Etc.

Is all equipment operative for the flight? Lights, x-ponder, flashlight batteries plus spares, life vests for that cut across the lake, first aid kit just in case, sickness bags for that novice passenger, maps, approach plates for destination and alternates enroute, etc.

At big airports be wary of jet blasts, you can be hidden from the tower by bushes where a DC-10 would be quite visible, following that "10 Heavy" for takeoff, lift off well before he rotates and slide to the up- wind direction to avoid the wing tip vortices which are dangerous horizontal tornado like winds shed from each wing tip. These vortices move down and out from each tip gradually dissipating but remaining dangerous for up to two minutes or more. AVOID THEM.

SOURCES OF INFORMATION

There are numerous sources of information available to make your flying not only safer, but more enjoyable as well. Of course, the number one source is our FAA (or your country's regulating authority). F.A.R. Part 91 covers the "General Operating and Flight Rules" for the U.S. This document covers subjects such as the responsibilities of the pilot, use of flight plans, fuel requirements, right-of-way rules, etc. Not particularly enjoyable reading, but essential and educational.

Much current information is carried in the Airman's Information Manual, Advisories and Notices and other publications of U.S. origin.

Airman's Information Manual

The AIM provides pilots with basic flight information, Air Traffic Control (ATC) procedures for use in the U.S., a glossary of terms used by the pilot/controller during radio contact, pilot's medical information, accident and hazard reporting information, etc. It is revised at six month intervals and can be purchased locally or from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

Organizations such as the Aircraft Owners and Pilots Association (AOPA) and Jeppesen also publish their version of the AIM essentially in another format, but containing the same information.

Become familiar with the AIM and use the information in it to become and remain a more “professional” pilot.

Advisory Information

Notices to Airmen (NOTAMs) provide information of a time-critical nature which can affect the decision to go or not go... for example a closed airport, nav aids out of service, runway closures, etc.

FAA Advisory Circulars

These circulars are the FAA’s means of informing the flying public of non-regulatory items of interest. They cover a myriad of subjects and can be obtained at FAA offices, bookstores specializing in flying or government publications, some FBOs, etc. Some are free, and others have a nominal charge - all are worthwhile reading and of general interest to airmen. A complete listing of current advisory circulars is published as AC00-2, which lists those that are for sale, as well as those distributed free of charge by the FAA as well as ordering information.

Some of the free circulars are:

- 00-24 Thunderstorms
- 00-50 Low Level Wind Shear
- 20-5D Plane Sense
- 20-93 Flutter Due to Ice or Foreign Substance on or in Aircraft Control Surfaces
- 20-105 Engine Power Loss Accident Prevention
- 43-12 Preventative Maintenance
- 60-4 Pilot’s Spatial Disorientation
- 60-9 Induction Icing - Pilot’s Precautions and Procedures
- 61-67 Hazards Associated with Spins in Airplanes Prohibited from Intentional Spinning
- 61-84 Role of Preflight Preparation
- 90-23D Wake Turbulence
- 91-6A Water, Slush and Snow on Runway
- 91-43 Unreliable Airspeed Indications

A similar listing of publications could be prepared for Advisory Circulars which are not free however the cost is nominal.

Other publications include “General Aviation News” by the FAA, The Experimental Aircraft Association (EAA) magazine” Sport Aviation “is a very valuable source of special interest topics for your aircraft both during its construction and after. The

Lancair newsletter titled, "Lancair Mail" which is obviously oriented specifically to our Lancairs, and of course this Handbook.

GENERAL FLIGHT TOPICS

Flight Plans

Plan your flight and fly your plan. Words worth remembering and following. Planning means checking the weather, NOTAMS, aircraft, and planning "what if's" so that you are never backed into a corner. Someone on the ground should always know where and when you are going and by what route. Enroute an occasional weather check for the destination is prudent if there is anything but severe clear in the area. Since your Lancair has "long legs", you can well expect significant weather changes between takeoff and landing both in terms of temperatures and types of weather. Over deserts in the summer calls for carrying some drinking water, perhaps a sleeping bag, and some plastic sheet for sun protection - just in case. Winters calls for warm clothing, matches for a fire, etc. Like the Boy Scouts, "Be Prepared".

Mountain Flying

Flight of small aircraft over mountains and in mountainous areas is different from "flat lander" flying. It is extremely quick transportation compared to ground means and can be done safely, but is not without its special concerns. Operation of the aircraft is generally at much higher altitudes where engine performance is poorer, and stall speeds are higher due to the less dense air. Care must be taken to allow for these effects by reducing the gross weight if necessary. More room must be allowed for takeoff and landings and slower climb rates expected. In addition, the weather is significantly different. Winds can be extremely strong and turbulent especially between the passes where we tend to go to improve terrain clearance. The weather can change in very short periods of time, both to the good and to the bad. In the winter weather fronts can make crossing a range of mountains next to impossible at times with short periods of acceptable time in between the fronts. Even then however the winds and turbulence can be extreme. Obtain the advise of "locals" before venturing into this unknown. They can provide you with required/desired equipment, best routes, service possibilities and such to make your crossing more comfortable. Nights and mountains almost always calls for IFR operations. The MEAs, ATC following, someone to talk to and listen to are most comforting. Always follow airways as "the rocks" are not visible at night. NEVER ATTEMPT TO SCUD RUN.

Severe Weather

Your Lanfair is stressed for all but the most severe maneuvers but anything man can build he can break. Severe weather means dangerous wind shears and vertical air movements. These can often be seen as evidenced by cumulus or lenticular clouds, but not always. Winters can lower the jet stream into our flight altitudes where wind shears can result in clear air turbulence. Should surprise add some adrenaline into the picture over stressing could be a problem. The same could be true busting thru a front with thunderstorms. The answer - DON'T.

Icing

Your Lanfair performance is the result of both a clean design aerodynamically and a laminar airfoil which provides lift with less drag penalty than conventional airfoils. While bugs on the leading edge will reduce your performance a small amount, ice has the potential to not only reduce its lifting capability, but also will significantly increase drag and stall speeds and, more importantly change your stall characteristics.

Should you begin to accumulate ice in flight, as soon as you notice it attempt to avoid by changing altitude or reversing course. (Remember that preflight briefing where you noted the potential for icing and determined what your "out" would be?) If that ice does not sublimate (evaporate as ice) or melt prior to your landing, increase your approach speed and land "hot". If circumstances permit, make an opportunity to feel out the approach to stall characteristics before attempting the landing.

WARNING

Do not take the aircraft into a "full" stall. While decelerating slowly feel out the controllability of the aircraft. As soon as an acceptably low speed is reached to allow landing at the intended airport accept that, add about 5 kts and land. Stall/spin characteristics of the Lanfair with ice have not been evaluated AVOID!

Flight into known icing is prohibited. Flight into inadvertent icing is not to be treated lightly. Remember that other systems may be affected such as the pitot system. If flying in IMC conditions have the pitot heat ON. If no heater is installed be extremely aware of the potential for blockage at air temperatures approaching and below 32°F (0°C), and exit those conditions as soon as possible.

Marginal VFR Flight

Flight in VFR conditions is what we normally think of, but... Statistics suggest that marginal VFR is where problems often occur. Again the preflight weather briefing should include the weather man's (and your own) assessment of the potential for less than VFR conditions. Do not attempt to mix VFR and IFR conditions. If the weather is "marginal", and if you're not IFR equipped, rated and current, wait it out.

Night Flying

Night flight should be considered as marginal VFR. In many countries IFR flight plans are required for night flights - and for good reason. Forced landings off-airports are problematical at best. Clouds are hard to see ahead, and in some locations there are as many stars in the sky as lights on the ground and "which way is up" becomes a problem without reference to the instruments. Use the MEAs for altitudes flying enroute, and approach plates for terminal area altitudes and flight paths and be on the alert for "spacial disorientation" or vertigo as it is commonly called.

On the positive side, night flights are quite rewarding in many ways. The air is smoother, traffic is lighter later in the evening, and on clear nights dead reckoning navigation from lights to lights is easier due to generally clearer air. With a well equipped and operating aircraft acceptable terrain enroute, and predictable surface winds (just in the case of engine failure) night flights have their own special reward.

Vertigo & Hypoxia

Vertigo is the condition where your inner ear, based on gravity, gives you that sense of "which way is up". Small prolonged accelerations in any direction, a low rate uncoordinated turn will affect the inner ear fluid such that down is no longer down, but off to one side and you will sense that you're in a turn. When there are few or no visual clues (nights or IMC conditions without a good horizon) to correct this sense the result can be vertigo. BELIEVE YOUR INSTRUMENTS - PERIOD. The message is be alert for vertigo.

Vertigo is as insidious as hypoxia, that high altitude phenomena resulting from lack of oxygen. The regulations limit flight altitudes to 12,500 feet when operating without pressurization or oxygen. Hypoxia is the result of an insufficient supply of oxygen to the blood the result of which is insufficient oxygen to the brain cells. The manifestations of hypoxia vary from individual to individual and day to day however in general the following are symptoms in the order in which they occur;

1. Loss of peripheral (side) vision
2. Bluish fingernails vs reddish color

3. Sense of euphoria or well being
4. Seemingly darker than normal lighting conditions
5. Grey-Qut
6. Black-Qut

Somewhere in this sequence an in-flight decision can be made which is wrong or improperly reacted to, or just ignored. Loss of control or over-control of the aircraft is a typical result and an accident occurs. This type of loss of control is serious - an accident is almost inevitable. Hypoxia is a dangerous condition. It is not limited to VFR pilots. IFR rated pilots who are not up to par because of medicines, mental stress, turbulence, or other condition are also subject to the condition. All pilots should be particularly wary of and on the lookout for these symptoms - their lives and the lives of their passengers depend on it!

Hyperventilation, a kissing cousin of hypoxia, is another breathing anomaly. However rather than lack of oxygen, it is the result of over breathing which upsets the balance of oxygen and carbon dioxide in the blood. The resulting symptoms are similar. The correction is rather the opposite however, i.e. hold your breath and then breathe slowly and deliberately. The general cause of hyperventilation is stress, nervousness, anxiety, fright, etc. Upon the realization of the symptoms, evaluate the potential cause and take the appropriate action. Recovery from hypoxia is dependent upon obtaining oxygen (lower altitude). Hyperventilation requires a few seconds for the blood balance to be restored.

Both of these problems are aggravated by smoking and alcohol which also upset the bloods ability to carry oxygen to the brain. Avoid them for your safety and that of your passenger. The presence of carbon monoxide in the cockpit can result in similar symptoms also. An open vent to increase cabin ventilation should be used even to the extent of colder than desirable temperatures. This latter should be anticipated if an exhaust heater is being used. A carbon monoxide detector in the cockpit is good insurance for winter operations.

Engine failures

An all too sad fact is that engines can fail at any time. One of the most likely and worst times is on takeoff as this is when the most is being asked of the engine and there is the least amount of time to react.

On takeoff, if runway exists, attempt to stop, and even accept an overrun "into the weeds". After lift off the number one rule is to maintain flying speed. Climbing at V_x (greatest altitude for the distance traveled) after rotation provides the most altitude in the least amount of time and reduces your exposure to that low altitude glide to a landing. Do not attempt to turn around unless you have 1000 feet AGL,

just land on the remaining runway or within $\pm 30^\circ$ of the takeoff heading, maintaining control thru initial impact and until the aircraft comes to rest. Should you ever have this unfortunate occurrence you'll be happy you used all the runway available rather than made the takeoff from the intersection to avoid the long taxi to the "far end" of the field.

Again on the positive side, engine failures without warning are extremely rare. Being mechanical devices there is almost always some warning of a failure. Oil consumption increases, vibration increases due to the stuck valve, reduced power shows itself by an increased takeoff time and distance, metal chips are caught in the oil filter, etc. Paying attention to your "one and only" is most important. As suggested earlier, engine instruments are now available which can provide the information which, when faithfully tracked, will warn of failure of this mechanical marvel.

If you have a carbureted engine, one almost mandatory piece of data you can install is a carburetor temperature gauge to warn of ICE. This is, like hypoxia, an insidious "disease" of your engine. It can strike almost without warning and at any time from takeoff on. It is generally evidenced by roughness, and or loss of power. An accurate diagnosis, timely acted upon will cure the engine as evidenced by the great number of aircraft equipped with carburetors as opposed to a fuel injection system. Moist air at temperatures of 40 to 70°F are ideal conditions for carburetor icing. Be aware and you and your carburetor can live happily ever after.

Water in the fuel system is another cause of engine failure. In cold weather it can freeze in the filter, tank or lines and limit or totally restrict fuel flow to the engine. Preflight checks can completely control this potential engine problem.

One problem which causes more engine failures than all others is simply lack of fuel. Either the tanks are dry or the fuel valve is not on the proper tank. The "original" system requires that you transfer fuel from the wings to the header tank. Failure of a transfer pump or failure to transfer will allow the header tank to run dry resulting in engine failure. Quick action can transfer fuel if its there and altitude exists such that the header tank can be supplied with fuel and the engine restarted. Letting the engine run dry from an empty header tank is simply irresponsible and of course very dangerous. You should develop the habit of always refilling the header tank when it is no more than half empty.

Oil is your engine's life blood. Making sure it is always adequately supplied with clean oil is some of the cheapest insurance you can buy. In winter a lighter (thinner) grade is called for than in summer, and preheating may be not only desirable, but necessary. Such heating will also limit the wear which occurs during start-up when engine temperatures have not stabilized the internal clearances and the oil's

viscosity is not yet normal. High power settings before the engine has reached minimum temperature also thermally stresses the engine.

All of the above simply says it is prudent to treat your engine with all the care it deserves and it will in turn take care of you.

Aerobatics

Your Lancair is capable of many aerobatics when properly flown. Aerobatics are controlled maneuvers which incorporate “unusual attitudes” during their accomplishment. A barrel roll for example is a 1 “G” maneuver when properly executed. A loop is basically a 3.5 “G” maneuver. Properly flown they do not load the airframe such that either load factor (“G’s”) or speed (V_{ne}) are exceeded. “Properly flown” is the key phrase. It is not wise to learn to do by doing such maneuvers. Some aerobatic instruction is mandatory.

The use of a parachute is required by regulation, and a weight restriction is in effect during aerobatic maneuvers. Aerobatics are essentially single seat, with no other weight in the fuselage.

Improperly flown maneuvers can result in reaching a stalled condition and a yaw at the same time, the recipe for a spin. The Lancair has demonstrated its ability to recover from spins at both forward and aft CGs with the standard recovery technique, i.e. opposite rudder, stick forward to unstall the wings and fly out of it. Positive load factor smoothly applied is required to prevent excessive speed buildup. The sooner the spin is recognized and recovery initiated the less altitude will be lost and the lower the speed buildup will be. Power changes during aerobatics (from full throttle to idle) occur rapidly and thermal shock can be a factor in your engines life.

Always remember, your Lancair is very “slick” aircraft thus speeds increase very rapidly during descents, stalls or incipient spins and you will consume great amounts of altitude during recovery. The best aerobatic aircraft is always a “draggy” aircraft and your Lancair is at the opposite end of that spectrum.

**HAPPY FLYING
&
KEEP IT SAFE**