PILOT'S OPERATING HANDBOOK

and

AIRPLANE FLIGHT MANUAL

for the

LANCAIR® 235 320 360

Mfgr's Serial No. ____________________
Registration No. ____________________

This aircraft is FAA Approved in the EXPERIMENTAL category based on FAR 23. This document may be carried in the aircraft at all times.

Owners are encouraged to evaluate their own check-lists and owner developed manual data for completeness based on this handbook.

Published by

Lancair International Inc.

Redmond, Oregon 97756

Authorized Dealer

Neico Aviation Inc.
2244 Airport Way
Redmond, Oregon 97756

PILOT'S OPERATING HANDBOOK

and

AIRPLANE FLIGHT MANUAL

December, 1994

Log of Revisions

PAGES	DESCRIPTION

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 235, 320 and 360 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 your Lancair 235/320/360.

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 your Lancair.

General

Section I

Intentionally Left Blank

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 appplicable 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 responsiblity 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 to obtain the maximum prudent usefulness and safety from your Lancair 235, 320 or 360.

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. It's 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 235/320/360s, some optional equipment have 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

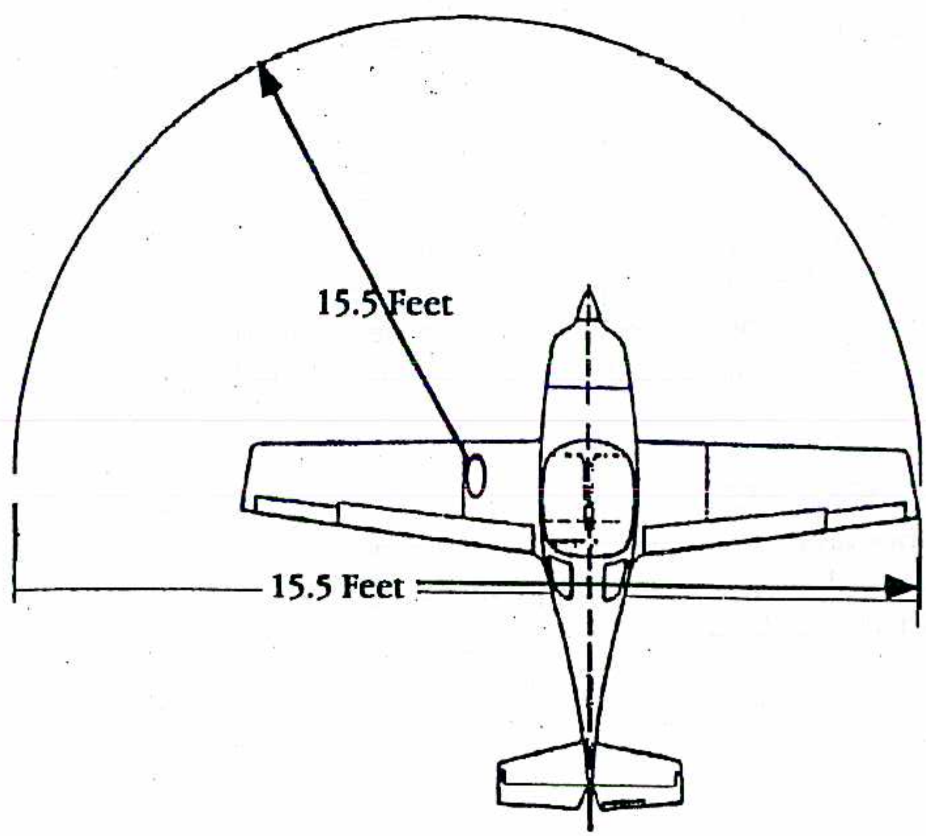
When this handbook is used for airplane operational purposes, it is the pilots responsibility to maintain it in current status.

AIRPLANE FLIGHT MANUAL SUPPLEMENTS REVISION RECORD

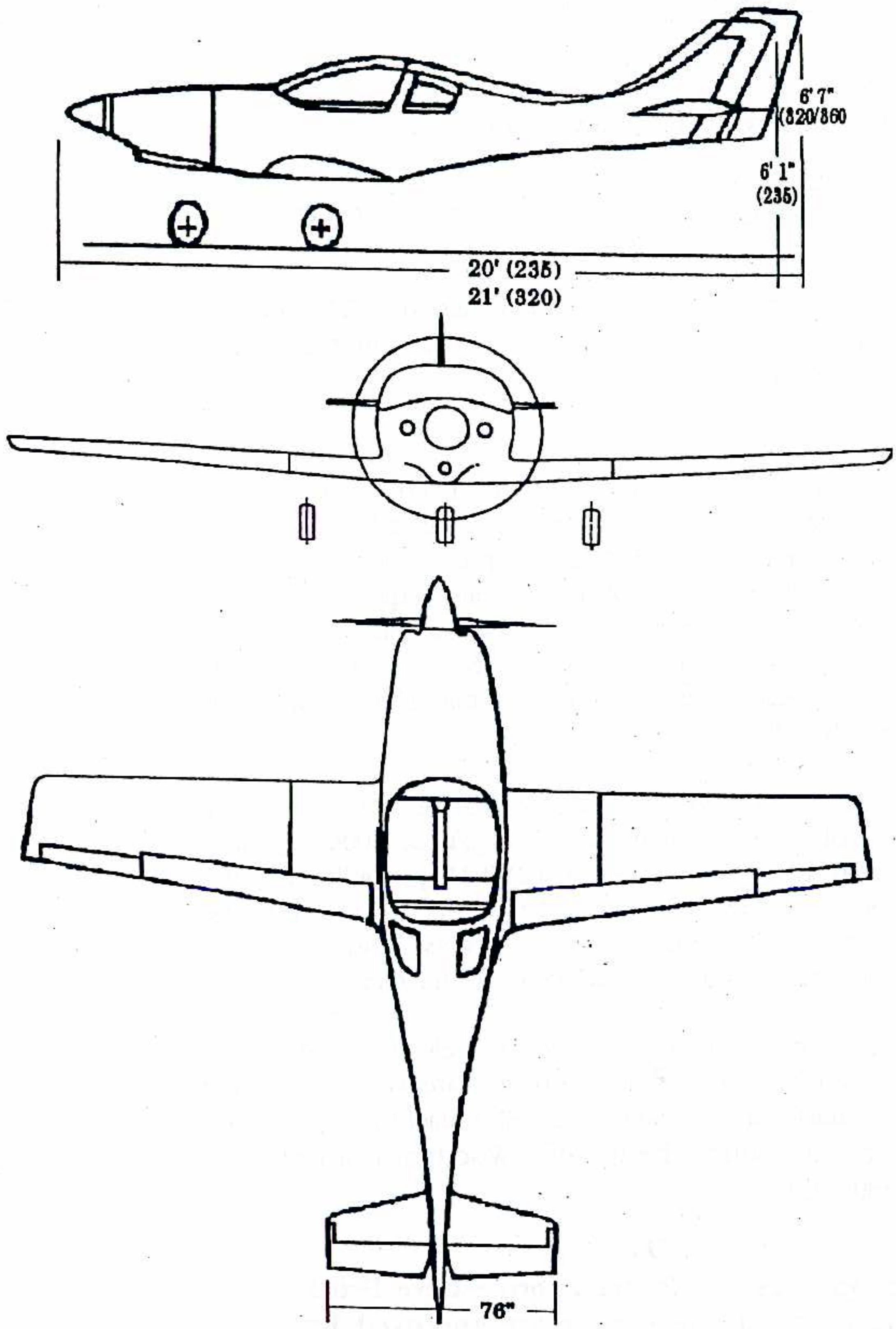
Section IX contains the Lancair Airplane Flight Manual Supplements headed by a Log of Supplements page. On the "Log" page is a listing of the Lancair Supplemental Equipment available for installation on the airplane. When new supplements are received or existing supplements are revised, a new "Log" page 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.



Ground Turning Clearance



Airplane Three View

DESCRIPTIVE DATA

ENGINES

The Lancair can be fitted with the following engines:

Model 235 - Lycoming O-235, and O-290.
Model 320/360 - Lycoming O-320-DIF, IO-320-D1B, O-360-A1A, IO-360-B1B.

Take-off and maximum continuous operation varies from 118 (Model 235) to 180 (Model 360) horsepower for the various engines. Performance of the airplane varies accordingly.

PROPELLERS

The Lancair 235 aircraft are typically fitted with fixed pitch wooden propellers. They must be installed in accordance with the prop manufacturers' requirements. Key issues are prop bolt torque settings, periods between torque checks, crush plate requirements and general care of the prop. An electrically controlled constant speed MT propeller has been flown with benefits in all realms of flight. Fixed pitch units require a 4 inch extension to the propeller shaft. Maximum recommended length 62".

The Lancair 320 uses a Hartzell constant speed HC-F2YL-1 hub, F/F8468D-14 blades, of 70 inch diameter and p/n 205-0040 spinner assembly. Hartzell has approved the HC-F2YR-1F propeller for the 360, however ground clearance is reduced by 1 inch. Care must be exercised and accordingly it is not well suited for grass fields. The nose oleo must be kept well charged to maintain ground clearance.

The MT propeller, a constant speed, two blade electric, requires an MT controller p/n 480-0010. Other MT propellers are available for the range of engines suitable in the Lancair 320/360 machines. Other MT units are hydraulic, and require the use of a Woodward or McCauley governor, p/n 480-0011.

NOTE

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

FUELS

Lancair 235 - Av gas 80/87 or 100LL as required, 80/87 minimum grade [unless STC'd for auto fuel]
Lancair 320/360 - Av gas 100LL (blue) or 100 (green)

Standard System Capacities

Lancair 235	33 gallons (U.S.)
Lancair 320/360	Standard-43 gallons
Long range....................................	53 gallons
Total Usables resp..............	32, 42, 52 gallons

OIL CAPACITIES

Lancair 235	6 quarts (U.S.)
Lancair 320/360	8 quarts (U.S.)

CABIN AND ENTRY DIMENSIONS

Length - 235, 320/360	62, 62/62 inches
Height - 235, 320/360	38.5, 42.5/42.5 inches
Width - 235, 320/360	42, 42.7/42.7 inches

BAGGAGE

Compartment Volume approx 14 cu ft

SPECIFIC LOADINGS (Max Take-off Wt)

Wing Loading -

235, 320/360 18.42, 22.17 lbs/sq ft

Power Loading -

235, 320/360 11.8, 10.53/9.36 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);
4) 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.

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.

NOTES:

NOTES:

Limitations

Section II

Table of contents

Intentionally Left Blank

GENERAL

The data approved by Lancair International and the Limitations presented herein are those established by Lancair as applicable to the Models 235, 320/360 aircraft. Where there are differences between these models it will be so identified.

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 or mph. If there is instrument (gauge) error that needs to be factored in also to reach KIAS.

AIRCRAFT OPERATING SPEEDS

Lancair 235

SPEED	MARKING		KCAS	(mph)
Never Exceed Speed	V_{ne}	Red Line	215	(248)
Caution,smooth air only		Yellow Arc	165-215	(190-248)
Maneuvering Speed	V_a		117	(135)
Normal Oper Range	V_{no}	Green Arc	61-165	(70-190)
Full Flap Oper Range	V_{fe}	White Arc	48-100	(55-114)
Landing Gear Speed	V_{le}/V_{lo}		122	(140)

Lancair 320/360

SPEED	MARKING		KCAS	(mph)
Never Exceed Speed	V_{ne}	Red Line	235	(270)
Caution,smooth air only		Yellow Arc	183-235	(210-270)
Maneuvering Speed	V_a		143	(165)
Normal Oper Range	V_{no}	Green Arc	70-183	(80-210)
Full Flap Oper Range	V_{fe}	White Arc	54-100	(62-114)
Landing Gear Speed	V_{le}/V_{lo}		122	(140)

POWERPLANT LIMITATIONS

Engines

These Lancairs are powered by standard aircraft engines, the power varying from 118 to 180 HP. They are horizontally opposed, air cooled, four cylinder engines made by Textron Lycoming.

OPERATING LIMITATIONS

Operating limitations for the various engines used in the Lancair Models 235, 320, and 360 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 235

118 HP, O-235-L2C Specification

T.O. & Max Continuous RPM

Full throttle, red line, 2750 rpm
Normal operation, 600(idle) 2200-2700 rpm(cruise)

Cylinder Heat Temperatures

Maximum, 450°F (232°C)
Normal Operating Range, 200-430 °F (90-221°C)
Recommended, 380-410°F (193-210°C)

Oil Temperatures

Maximum, 240°F (115°C)
Desired Operating, 210°F (100°C)

Oil Pressure

Minimum Operating (idle), 40 psig (2.72 atm)
Normal Operation, 60-70 psi (4-4.76 atm)
Maximum (starting & warm up), 80 psi (5.44 atm)

Fuel Flow

75% cruise, 2500 rpm/6.7 gph
65% cruise, 2400 rpm/5.8 gph

Fuel Pressure (carbureted)

Maximum, 6.0 psig(0.41 atm)
Recommended, 4.0 psig (0.27 atm)
Minimum, 2.0 psig (0.136 atm)

Vacuum Pressure

Normal Operating Range, 4.8-5.2 In.Hg.

Lancair 320

160 HP, O-320-D1F Specification

Power Settings

Full Throttle, 160 HP, 2700 rpm
75% Pwr, 120 HP, 10 gph, 2450 rpm
65% Pwr, 104 HP, 8.8 gph, 2350 rpm
Normal Operation, 600-2700 rpm

Cylinder Head Temperatures

Maximum, 500 °F (260°C)
Normal Operating Range, 150-400°F

Oil Pressures

Minimum Operating (idle), 25 psig (1.7 atm)
Normal Operation, 55-95 psig (3.74-6.46 atm)
Maximum, starting & warm up, 115 psig (7.8 atm)

Fuel Pressure (Carbureted)

Maximum, 8 psi (0.54 atm)
Recommended, 3.0 psi (0.20 atm)
Minimum, 0.5+ psi (0.035 atm)

Vacuum Pressure

Normal Operating Range, 4.8-5.2 in.Hg.

Lancair 320

160 HP, IO-320-D1B Specification

Power Settings

Full Throttle, 160 HP, 2700 rpm
75% Pwr, 120 HP, 10 gph, 2450 rpm
65% Pwr, 104 HP, 8.8 gph, 2350 rpm
Normal Operation, 600 (idle) 2700 rpm(cruise)

Cylinder Head Temperatures

Maximum, 500 °F (260°C)
Normal Operating Range, 150-400°F(66-205°C)

Oil Pressures

Minimum Operating (idle), 25 psig (1.70 atm)
Normal Operation, 55-95 psig (3.74-6.46 atm)
Maximum, starting & warm up), 115 psig (7.8 atm)

Fuel Pressure (Injected)

Normal 19-25 psig (1.29-1.70 atm)

Boost Pump (For Injected engines)

Maximum (zero flow), 45 psi (3.06 atm)
Minimum flow (Full fuel flow), 12 psi (0.82 atm)

Vacuum Pressure

Normal Operating Range, 4.8-5.2 in.Hg.

Lancair 360

180 HP, O-360-A1A Specification

Power Settings
- Full Throttle, 180 HP, 2700 rpm
- 75% Pwr, 135 HP, 10.5 gph, 2450 rpm
- 65% Pwr, 117 HP, 9.0 gph, 2350 rpm
- Normal Operation, 600-2700 rpm

Cylinder Head Temperatures
- Maximum, 500 °F (260°C)
- Normal Operating Range, 150-400°F

Oil Pressures
- Minimum Operating (idle), 25 psig (1.70 atm)
- Normal Operation, 55-95 psig (3.74-6.46 atm)
- Maximum, starting & warm up, 115 psig (7.82 atm)

Fuel Pressure (Carbureted)
- Maximum, 8 psi (0.54 atm)
- Recommended, 3.0 psi (0.20 atm)
- Minimum, 0.5+ psi (0.034 atm)

Vacuum Pressure
- Normal Operating Range, 4.8-5.2 in.Hg.

Lancair 360

180 HP, IO-360-B1B Specification

Power Settings
- Full Throttle, 180 HP, 2700 rpm
- 75% Pwr, 135 HP, 11.0 gph, 2450 rpm
- 65% Pwr, 117 HP, 8.5 gph, 2350 rpm
- Normal Operation, 600-2700 rpm

Cylinder Head Temperatures
- Maximum, 500 °F (260°C)
- Normal Operating Range, 150-400°F

Oil Pressures
- Minimum Operating (idle), 25 psig (1.70 atm)
- Normal Operation, 55-95 psig (3.74-6.46 atm)
- Maximum, starting & warm up, 115 psig (7.82 atm)

Fuel Pressure (Injected)
- Maximum, 35 psi (2.38 atm)

Boost Pump (Injected)
- Maximum (zero flow), 45 psi (3.06 atm)
- Minimum flow (Full fuel flow), 12 psi (0.82 atm)

Vacuum Pressure
- Normal Operating Range, 4.8-5.2

FUEL GRADES (Aviation Gasoline)

Lancair 235

Engine dependent, 80/87 or 100LL*

Lancair 320/360

100LL* or 100** minimum

*Blue, **Green, Maximum lead content 2 cc/gal

OIL SPECIFICATION

Following initial break-in of the engine it should be operated with an ashless dispersant oil (MIL-L-22851) conforming to the applicable Lycoming 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.

POWERPLANT INSTRUMENT MARKINGS

It is recommended that the following markings be made on the engine instrument gauges to conform to convention.

NOTE

Lycoming IO-360 values shown. The owner/operator should compare and correct (where different) for the particular model specifications for his installation.

OIL TEMPERATURE

Caution (Yellow Radial)	200 to 245°F
Normal Oper Range (Green arc)	140 to 190°F
Maximum (Red radial)	245°F

OIL PRESSURE

Minimum (Idle, Red radial)	25 psi
Caution Range (Yellow arc)	25 to 50 psi
Operating Range(Green arc)	55 to 95 psi
Maximum (Red radial)	115 psi

TACHOMETER

Operating Range (Green arc)	600 to 2700 rpm
Maximum (Red radial)	2700 rpm

CYLINDER HEAD TEMPERATURE

Operating Range (Green arc)	150 to 400°F
Maximum (Red line)	500°F

MANIFOLD PRESSURE

Operating Range (Green arc)	15 to 29.6 in Hg.
Maximum (Red radial)	29.6 in. Hg.

MISC INSTRUMENT MARKINGS

VACUUM PRESSURE

Operating Range (Green arc)	4.8 to 5.2 in. Hg.

HYDRAULIC PRESSURE

(Not normally monitored)

Gear up	1,200 psi
Gear down	0 to 600 psi

WEIGHT LIMITS

Lancair 235:

Maximum Take-off Weight	1400 lbs
Maximum Landing Weight	1400 lbs
Standard Empty Weight	880 lbs
Maximum Baggage Weight	50 lbs

Lancair 320/360:

Maximum Take-off Weight	1685 lbs
Maximum Landing Weight	1685 lbs
Standard Empty Weight	1100 lbs
Maximum Baggage Weight	60 lbs

CENTER OF GRAVITY LIMITS (Gear Extended)

The allowable Center of Gravity (GC) range is from Fuselage Station (FS) 24.5 to FS 30.3. This is valid for both the Model 235 and the 320/360. The aft CG limit is FS 30.3, and must be considered a firm limit. Loadings which place the CG further aft are dangerous and must not be accepted. A "Weight and Balance" sheet must be completed and carried in the aircraft at all times. See Section VI.

REFERENCE DATUM

The datum, i.e. Fuselage Station zero (0) is the back (aft) side of the firewall. (This is easily located through the nose wheel gear well.)

MEAN AERODYNAMIC CHORD

The MACs corresponding to the CG limits of 24.5 and 30.3 are 15% and 29% respectively.

MANEUVER LIMITS

The Lancair Model 235 and 320/360 aircraft are 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

MANEUVER	ENTRY SPEED	MAX G'S
Chandelle	160 Kts	3.5
Lazy Eight	180 Kts	1.0 to 1.5
Stalls (not whip stalls)*	—	0.0 to 1.5
Loops	180 Kts	3.5
Aileron Rolls*	160 Kts	-1.0* to 1.0
Barrel Rolls	150 Kts	1.0
Split-S	85 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 Lancair is highly desirable. Speed buildup during these maneuvers can be rapid and proper control usage is essential throughout the maneuver to remain within limits.

Minimum fuel in the header tank is 8 gallons, Model 320/360 optional wing tanks should be empty. Sideslips should be limited to 30 seconds maximum and oil pressure should be monitored in accordance with the note above (*WARNING). Aerobatics are not approved with wing tip extensions.

FLIGHT LOAD FACTOR LIMITS

Flaps up, at gross weight	+4.5, to -2.3 g
Flaps down, at gross weight	+2.5 to -2.0 g
Flaps up, at 1350 pounds	+6.0 to -3.0 g

TYPES OF OPERATIONS AND LIMITS

The Lancair Models 235, 320, and 360 are approved for the followin types of flight when the required equipment is installed and opera tions 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.)

Header tank	11* gallon
*(may be less based on the type of canopy actuation)	
Model 235 Wing Tanks (per wing)	11 gallon
Model 320/360 Wing Tanks (per wing)	16 gallon
Model 320/360 Optional wing tanks/wing	21 gallon

FUEL MANAGEMENT

Do not take-off with less than 8 gallons in the header tank. Since th engine is supplied fuel solely from the header tank, fuel must b transferred from each wing tank to the header tank periodically. Ther is no interconnection between the wing tanks. A header tank floa operated warning light can be installed for alerting purposes. Fue must be transferred from each wing by the pilot, maintaining left/righ wing balance.

WARNING

Failure to shut off the fuel transfer pump from either wing tank could result in the pumping of fuel over-board, out the header tank vent line, and/or loss of the header tank cap from excessive pressurization.

SEATING

These aircraft seat two, side by side, and can be flown from either seat (although dual rudder pedals and brakes are an option).

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 labled 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.

In addition, the following are some recommended placards:

In front of the pilot;

Airspeed Limitations	
Max Lndg Gear Ext Speed	122 Kts
Max Flap Ext Speed	100 Kts
Max Full Flaps	100 Kts

Near the header tank gauge;

Do Not Take-off With Less Than 8 Gallons in Header Tank

Model 235/320/360;

Near the fuel gauges OR fuel transfer pumps;

____ Gallons Usable	____ Gallons Usable

Emergency landing gear extension (near gear)

Maximum	87 Kts
Gear CB	OUT
Gear Switch	DOWN
Gear Dump Valve	OPEN
Gear	3 Lights

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:

NOTES:

NOTES:

NOTES:

Emergency Procedures

Section III

Table of contents

Intentionally Left Blank

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

(Best airspeeds will vary based on your airframe construction- verify and adjust as required.)

ITEM	CONDITION
Emer Descent (Gr Dn)	122 kts then to 140 kts (140 - 170 mph)
Best Glide	104 kts (120 mph)
Ldng Appr (w/o Pwr)	87 kts (100 mph)

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.

ITEM	CONDITION
Establish	**87 kts**
Declare	**EMERGENCY**
Check Fuel Pump	**ON**
Fuel transfer pumps	**ON**
Mixture	**RICH**
Magneto,Cycle, return to	**BOTH**
Flaps (when on final)	**FULL**

In Flight

Establish 104 kt glide. Climb to reduce speed if practical, pick landing site. Attempt AIR START.

ITEM	CONDITION
Check header tank for fuel	
Fuel pump	**ON**
Fuel Transfer Pumps	**ON**
Mixture	**RICH**
Mags Cycle & return to	**BOTH**

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

ITEM	CONDITION
Adjust Mixture	**RICH**

If no improvement carefully lean for improvement as follows:

ITEM	CONDITION
Reduce pwr setting to approx	**2100 RMP**
Mags,Sw to LT, to BOTH,	
to RT, then to	**BEST**
Readjust mixture for	**BEST OPERATION**

NOTE

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

ENGINE FIRE

In FLIGHT

Determine if fire is electrical (acrid smell).

ITEM	CONDITION
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 cause.

If fire continues;

ITEM	CONDITION
Throttle	**IDLE**
Mixture	**CUT-OFF**
Fuel Shut-off Vlv (Rt Passenger foot well)	**OFF**
Fuel Pump	**OFF**
Fuel Transfer Pumps	**OFF**
Transponder	**7700**
Radio	**"EMERGENCY & LOCATION"** (Use active frequency or **121.5**)

Land immediately and exit the aircraft.

On ground (engine start or taxi)

ITEM	CONDITION
Throttle to	**IDLE**
Mixture	**CUT-OFF**
Radio, (Twr, Unicom, 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

ITEM	CONDITION
Power to	**IDLE**
Propeller to	**HIGH RPM**
Gear (upon slowing to 122 kts)	**DOWN**
Maintain (after gr dn & locked)	**148 KTS(170 MPH)**
Transponder	**7700 (or as requested)**

MAXIMUM GLIDE CONFIGURATION

ITEM	CONDITION
Gear	**UP**
Establish	**104 kts (120 mph)**
Flaps	**UP**
Propeller	**LOW RPM**

Glide distance is approximately 1.3 nm (1 1/2 statute miles) 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;

ITEM	CONDITION
Seat Belts/Shldr Harness	**TIGHT**
Canopy	**LATCHED** *
Gear	**UP or DOWN**
Fuel Pump	**OFF**
Fuel X-fer Pumps	**OFF**
Mixture	**CUT-OFF**
Mags	**OFF**
Flaps	**AS REQD**
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.

*** Note: On aircraft with the parallelogram canopy system it is permissable to unlatch the rear two latches only, below 104 kts (120 mph).**

SYSTEMS EMERGENCIES

PROPELLER OVERSPEED

The controllable pitch Hartzell propellers (with Woodward governors) used on the Lancairs utilize oil pressure from the governor to increase pitch (low rpm), others 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 o damage, the proper "care and feeding" of your propeller. Preflight your aircraft accordingly. The loss on 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. The battery will read approximately 12.4 volts on a full battery, and 14+ on the alternator. If you experience alternator failure;

ITEM	CONDITION
Master Switch	**OFF**
Avionics Master	**OFF**
Lights	**OFF**
Circuit Breakers	**CHECK**

The 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.

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:

ITEM	CONDITION
Airspeed, reduce to below	**87 kts (100 mph)**
Gear Circuit Breaker	**PULL**
Gear Switch	**DOWN**
Gear DumpValve	**OPEN**
Gear	**3-LIGHTS**
Gear Dump Value	**CLOSED**
Gear Circuit Breaker	**RESET**

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.

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

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.

UNLATCHED CANOPY IN FLIGHT

The Lancair has two types of canopy systems, one opening from the front, clam shell type, and the other on parallelogram hinges, opening up and forward.

Neither types of canopies can be opened in flight. Should a latch become disengaged from the locked position, slow the aircraft to approximately 85 kts (100 mph) 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 accellerated stall and another spin.

WARNING

The Lancairs are 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.

NOTES:

NOTES:

NOTES:

Normal Procedures

Section IV

Table of contents

Intentionally Left Blank

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 BUILDERS' AIRCRAFT

Max Demonstrated X-WIND Component - 20 kts

Take-off Speeds

Flaps UP (Model 235=faired, may need 5° down to compensate for flap below-up)

(Model 320 - 5°-10° Down)

Rotation, Model 235 - 52 KIAS (60 MPH)

Rotation, Model 320/360 - 56 KIAS (65 MPH)

Best Angle of Climb - V_x, 75KIAS (85 MPH)

Best Rate of Climb - V_y, 95KIAS (109 MPH)

Cruise Climb - 125 KIAS (140 mph)

Landing Approach

Flaps DOWN - 100 MPH

Flaps UP (0° deg, faired) - 115 MPH

Balked Landing Climb - 95 KTS

PREFLIGHT INSPECTION

COCKPIT - (Checklist)

ITEM	CONDITION
1. Control Lock	REMOVE
2. Landing Gear Switch	DOWN
3. Battery Switch	ON
4. Landing Gear Position Indicators	3-GREEN
5. Fuel Quantity	CHECK
6. Lights (If night flight)	CHECK
7. All Switches	OFF

WALK AROUND INSPECTION - (Checklist)

(Starting at Left Wing/Fuselage)

ITEM	CONDITION
1. Left Flap Attachments	**SECURE**
2. Left Aileron	**TRIM TAB PIN - SAFETIED**
Control Hinge	**SECURE, NO LOOSE SCREWS**
Motion	**FREE**
Span Edges	**NO CONTACT WITH TIP OF FLAP**
3. Wing Tip	**NO DAMAGE, CRACKED PAINT, SECURE**
4. Lt. Wing Up'r/Lwr surface	**SIGHT- SMOOTH, NO BUCKLING/DISTORTION**
Leading Edge Feel	**SMOOTH, NO DAMAGE, CLEAN**
Fuel Quantity	**ADEQUATE FOR FLIGHT, CAP SECURE**
Pitot head	**NO OBSTRUCTIONS (CHECK HEAT IF IFR)**
5. Left Main Gear	
Tire	**CONDITION/TREAD**
Chocks	**REMOVED**
Brake Pads	**CONDITION**
Brake Line	**NO CHAFING**
Springs	**SECURE**
Gear Doors	**NO CRACKS, LINKAGE SECURE BUT FREE**
Tank Sump	**DRAINED**
6. Left Nose Area	
Tank Sump	**DRAIN, CHECK FOR CONTAMINATION**
Tire	**CONDITION/TREAD**
Chocks	**REMOVED**
Strut	**3 TO 4 INCHES EXTENSION**
Cowling	**SECURE**
Cooling intakes	**NO OBSTRUCTIONS, BIRD NESTS, ETC.**

WARNING

Always assume the propeller is "Hot" and the engine ready to start when handling the propeller regardless of mag switch position.

CAUTION

*** See Propeller manufacturers instructions for nick and damage treatments and limitations. Damaged propellers are dangerous - failures can be catastrophic.**

ITEM	CONDITION
7. Propeller*/Spinner	
Secure, no cracks at attach screws	**SPINNER**
LE smooth, no nicks (dress as req'd)*	**BLADES**
8. Right Nose Area	
Oil Quantity	**7 QUARTS MINIMUM**
Dip Stick	**SECURE**
Inspection Door	**CLOSED/SECURE**
9. Right Main Gear	
Tire	**CONDITION/TREAD**
Chocks	**REMOVE**
Brake Pads	**CONDITION**
Brake Line	**NO CHAFING**
Springs	**SECURE**
Gear Doors	**NO CRACKS, LINKAGE SECURE BUT FREE**
Tank Sump	**DRAINED**
10. Right Wing	
Upper/Lower surface	**SIGHT- SMOOTH, NO BUCKLING/DISTORTION**
Leading Edge	**FEEL- SMOOTH, NO DAMAGE, CLEAN**
Fuel Quantity	**ADEQUATE FOR FLIGHT, CAP SECURE**
11. Wing Tip	**NO DAMAGE, CRACKED PAINT, SECURE**
12. Right Aileron	
Control Hinge	**SECURE, NO LOOSE SCREWS**
Motion	**FREE**
Span Edges	**NO CONTACT WITH TIP OR FLAP**
13. Right Flap	
Attach Points	**CK SECURE**
14. Right Fuselage	
Static Port	**CLEAN, NO OBSTRUCTIONS**
15. Tail Assembly	
Horizontal Stabilizer	**NO LEADING EDGE DAMAGE**
Vertical Stabilizer	**NO LEADING EDGE DAMAGE**

ITEM	CONDITION
Elevator/Rudder	FREE MOTION, NO RUBBING
Hinges	SECURE
Rudder cables	SECURE, NO BENDING OF CABLE TO FITTING

BEFORE STARTING - (Checklist)

1. Baggage	**Stowed, loose items SECURED**
2. Rudder Pedals	**ADJUSTED**
3. Seat Belts/Shoulder Harness	**Adjusted & SECURE**
4. Brakes	**Check and Hold**
5. Circuit Breakers	**Checked and IN**
6. Master Switch	**OFF**
7. Avionics Master Switch	**OFF**
8. Avionics Switches	**OFF**
9. Gear Switch	**DOWN**
10. Canopy	**LATCHED**

STARTING - (Checklist)

1. Master Switch	**ON**
2. Fuel Quantity	**CK, COMPARE WITH VISUAL CHECK**
3. Carburetor Heat/ Alternate Air	**OFF**
4. Mixture	**RICH**
5. Throttle	**OPEN 1/4 INCH**
6. Propeller	**IN (MAX RPM)**
7. Boost Pump	**CHECK OPERATIONS**
8. Prime	**AS REQUIRED**
9. Clear Propeller	**CALL "CLEAR"**
10. Magneto	**BOTH (AT CRANKING SPEED)**
11. Starter	**ENGAGE**
12. Throttle	**ADJUST TO 1000 RPM**
13. Oil Pressure	**CHECK (WITHIN 30 SEC OR SHUTDOWN)**
14. Alternator	**ON**
15. Radios/Avionics	**ON (AS REQ'D)**

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.	Mixture	**CUT-OFF**
2.	Propeller	**HIGH RPM**
3.	Throttle	**1/2 OPEN**
4.	Mags	**BOTH**
5.	Starter	**ENGAGE**
6.	Upon start, Throttle	**IDLE (≈1000 RPM)**
7.	Mixture	**RICH**

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.

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.

PRE-TAXI CHECKS - (Checklist)

1.	Clear aft area for personnel and aircraft prior to power application (propeller blast)	"CLEAR"
2.	Brakes	CHECK (at initial movement)

PRE TAKE-OFF RUN-UP - (Checklist)

1.	Canopy	LOCKED
2.	Area	CLEAR (Clear for prop, clear for prop blast)
3.	Brakes	SET
4.	CHT/Oil Temp	GREEN
5.	Throttle	1800 RPM
6.	Propeller (controllable)	CYCLE TWICE
7.	Mags	CHECK (Max 175 drop, 50 rpm difference)
8.	Throttle	IDLE, then 1000 rpm
9.	Suction	CHECK (4.8 - 5.2 in. Hg.)

BEFORE TAKE-OFF - (Checklist)

1.	Canopy	LOCKED (4 places, recheck)
2.	Seat Belts/Harness	SECURE
3.	Instruments*	CHECK
4.	Fuel Quantity	CHECK (Header FULL)
5.	Oil Press/Temp	CHECK, GREEN
6.	Breakers	IN
7.	Master Switch	ON
8.	Avionics Master	ON
9.	Radios	ON & SET
10.	Auto Pilot	OFF
11.	Transponder	TO Standby
12.	Propeller	FULL IN (Max RPM)
13.	Mixture	FULL RICH
14.	Boost Pump	As Desired

15. Fuel Transfer Pumps **OFF**
16. Trims **SET** (Aileron neutral, Elevator Take-off)
17. Flaps Set **TAKE-OFF** (235 = faired to 5°, 320 = 5°-10° below faired)
18. Controls Free **CHECK** (Proper throw and directions)

* NOTE: Allow enough time 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	**ON**
3. Approach and T.O. Area	**CLEAR**
4. Clearance from Tower	**RECEIVED AND ACKNOWLEDGED**
5. Takeoff Runway	**CLEAR**
6. Time Off	**NOTE**

TAKE-OFF & CLIMB - (Checklist)

1. Take-off Power	**2700 RPM**
2. Oil Temperature	**140°F MINIMUM**
3. Cylinder Head Temperatures	**150°F MINIMUM**
4. Check Eng Instruments <u>after</u> Power Application	
5. Check Flight Instruments	**OPERATING**
6. Rotate	**65 - 75 KTS**
7. Initial Climb	**95 KTS**
8. Upon Positive Climb, Landing not poss.	**GEAR UP**
9. At ≈ 700 feet AGL	**FLAPS UP**
10. Reduce Power	**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.

CRUISE - (Checklist)

1. Throttle — **SET**
2. Propeller — **SET**
3. Mixture — **LEAN AS REQ'D***
4. Header Fuel — **MONITOR, MAINTAIN 1/2 OR GREATER**

****NOTE***

- GENERAL LEANING RULES-

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, climb, and cruise power settings of above 75% power. 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.

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 proceduires with the specified equipment. It is prudent to know each method in case of equipment failure.

LEANING, EXHAUST GAS TEMPERATURE

1. Normally aspirated engines with fuel injectors or uncompensated carburetors.
   a. Maximum Power Cruise (Approx 75% power) - 150°F on rich side of peak EGT for best power. Monitor cylinder head temperatures.
   b. Best Economy Cruise (Approx 75% power and below) - Operate at peak to 50° lean 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

(Economy cruise, 75% power or less, without flowmeter or EGT gauge)

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

Carburetor Heat

The use of carburetor heat can be required during moist air operations when ambient temperatures range from 20°F to 90°F. This temperature decrease can cause the condensation of this moisture to form as ice in the intake passages and restrict airflow into the engine. The ice forms generally on the butterfly valve and is observed by a drop in manifold pressure or rpm or both.

To avoid this, all installations must be equipped with a system to preheat the incoming air and replace the heat lost due to vaporization. This is called carburetor heat. While the heated air melts or avoids the icing condition, it also reduces the amount of power available due to the commensurate reduction in air density, and also tends to move engine operation toward detonation range. Generally this heated air also avoids any filter in the intake system thus exposing the engine to particulates which may be present.

Ground operations should only confirm the operation of the Carburetor Heat system.

Take-offs should be made in the "Cold" position as during these high powers the possibility of icing is considered remote, and power is lost when using "Heat".

Climbs at 80% power and above should also be made "Cold". Should icing be suspected due to climbs thru IMC conditions, use heat sparingly and in conjunction with leaning of the mixture only enough to obtain smooth engine operation.

During flight operations operate in the Cold position however be alert for loss of power. This will be evidenced by engine roughness, an otherwise unaccountable loss in manifold pressure or RPM, or all three, depending on whether a constant speed or fixed pitch propeller is installed on the aircraft. If ice is suspected apply full carburetor heat and open the throttle to limiting manifold pressure and RPM. This will result in a slight additional drop in manifold pressure which is normal, and this drop will be regained as the ice is melted out of the induction system. When the ice has been cleared, return to the cold position. If a carburetor air temperature gauge or carb ice warning system is installed, partial heat may be used to keep the mixture above 32°F.

WARNING

It is not advisable to operate at partial heat without a carburetor air temperature gauge. Use full or no heat.

Landing Approaches should normally be conducted in the full cold position. Where ice is suspected, apply full heat however be alert that should an abort occur, the heat control should be moved to full cold immediately after full power is achieved.

Alternate Air

Fuel injected engines avoid most of the problems associated with carburetor icing as the fuel is injected under pressure at or near the intake valve, a relatively warm location and generally free of freezing conditions. Alternate air systems are provided to avoid filter or intake duct icing and in operation generally utilize air from a compartment of warmed air. Accordingly, manifold pressure will decrease and a power loss will be noted. High power settings are thus to be avoided lest detonation occur with its resulting damage to the engine. Bypassing of the filter also allows contaminated air to enter the engine similar to carburetor heat. Alternate air, like carburetor heat, should be considered a minimum use, and only when required condition.

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.	Master Switch	**ON**
2.	Mags	**BOTH**
3.	Header Fuel	**FULL**
4.	Fuel Pumps	**OFF**
5.	Altimeter	**SET (FOR BARO OR FIELD ELEVATION)**
6.	Mixture	**ENRICHEN THRU DESCENT OR FULL RICH**
7.	Power	**AS REQ'D (USE CAUTION, AVOID RAPID AND EXCESSIVE COOLING)**
8.	CHTs	**MAINTAIN GREATER THAN 180°F**

PRE-LANDING - (Checklist)

1.	Seat Belts/Shoulder Harness	**FASTENED**
2.	Header Tank	**1/2 OR MORE**
3.	Mixture	**RICH**
4.	Landing Gear	**DOWN (122 KTS MAX), 3-GREEN**
5.	Flaps	**FULL (100 KTS)**
6.	Propeller	**HIGH RPM**
7.	Brakes	**CHECK**
8.	Establish	**NORMAL APPROACH**

BALKED LANDING - (Checklist)

1.	Throttle	**FULL**
2.	Airspeed	**95 KTS, ESTABLISH CLIMB**
3.	Flaps	**RETRACT**
4.	Gear	**RETRACT**

AFTER LANDING - (Checklist)

(After turning off runway)

1. Flaps	**UP**
2. Strobes	**OFF**
3. Transponder	**OFF**
4. Lights	**AS REQUIRED**
5. Trim	**RESET FOR TAKE-OFF**
6. Time	**NOTE**

SHUTDOWN - (Checklist) (At parking site)

1. Radios	**OFF**
2. Avionics Master	**OFF**
3. Throttle	**1000 RPM**
4. Mixture	**IDLE CUT-OFF**
5. Mags (After engine stops rotating)	**OFF**
6. Lights	**OFF**
7. Master Switch	**OFF**
8. Chocks/Tiedown	**COMPLETE**

ABBREVIATED TAKE-OFF CHECKLIST - (CIGAR)

Controls	**FREE AND CORRECT**
Instruments	
Gear Switch	**DOWN**
Circuit Breakers	**IN**
Altimeter	**SET**
Directional Gyro	**SET**
Radios	**SET**
Engine Instruments	**IN GREEN**
Gas	
Shut Off	**OPEN**
Boost	**AS DESIRED**
Transfer Pumps	**OFF**
Fuel Pressure	**CHECK**
Header Tank	**FULL**
Mixture	RICH

Attitude

Canopy	Latched
Seat Belts/Harness	SET
Flaps	SET, 235 = faired, 320 = 5°-10° Down
Trim	SET
Autopilot	OFF

Run-up

Brakes	SET
Nose wheel	Straight
Mag Check	1800 RPM, 175 max each, 50 rpm difference
Propeller	2 CYCLES
Oil Pressure	IN GREEN

ABBREVIATED LANDING CHECKLIST - (GUMP)

Gas

Header Tank	FULL
Boost	AS DESIRED
Transfer Pumps	OFF
Fuel Pressure	CHECK

Under Carriage

Gear	DOWN, 3-GREEN (122 kts max)
Flaps	FULL, @ 100 kts (114 mph)

Mixture

Mixture Control	RICH

Prop

Propeller Control	HIGH RPM (In)

HEATING & VENTILATION

Cooling air. Your Lancair is typically equipped with simple air intake scoops for cabin ventilation. Accordingly a simple open/closed valve is used to control air flow thru the intake scoop.

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.

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:

NOTES:

Performance

Section V

Table of contents

Intentionally Left Blank

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 1) "Tower passes", 2)A known aircraft and the "pacer" method, or 3)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

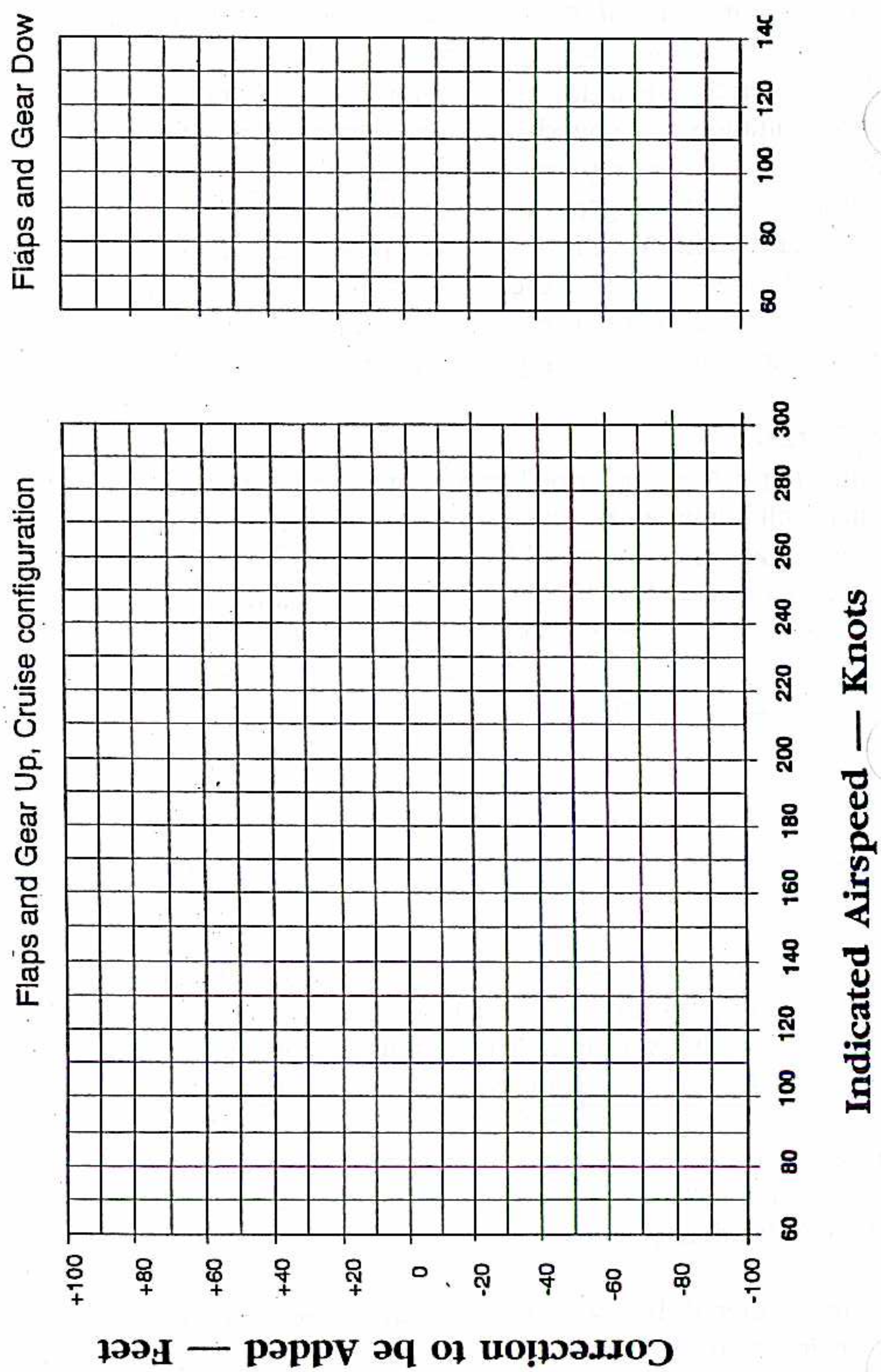
Pacer tests consist of flying side-by-side with another aircraft with a "known" static [generally "Wichita wagons"] recording both aircraft's speeds and altitudes at various test aircraft configurations of gear and flaps settings, and across the applicable speed range. Corrections to the test aircraft's 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 non-forgiving 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. These 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

AIRSPEED 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 and/ or DME can also 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.

These 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 kt 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

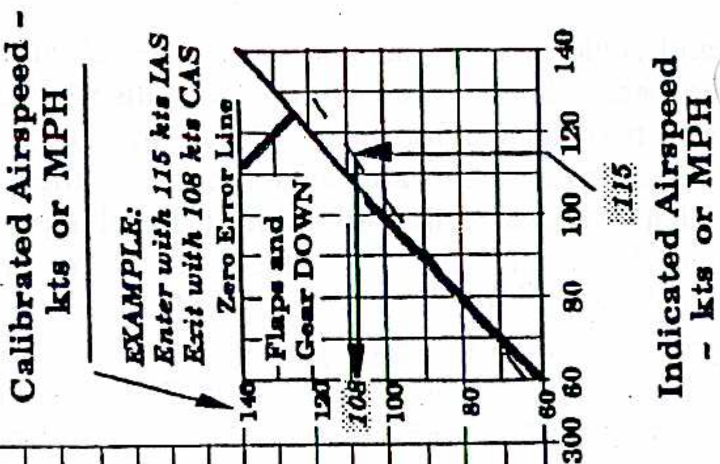
Cruise Configuration		
For actual Kts / mph	Add	Indicated kts/mph
80	+5	85
90	+5	95
100	+4	104
110	+2	112
120	0	120
130	-1	129
etc.		etc.

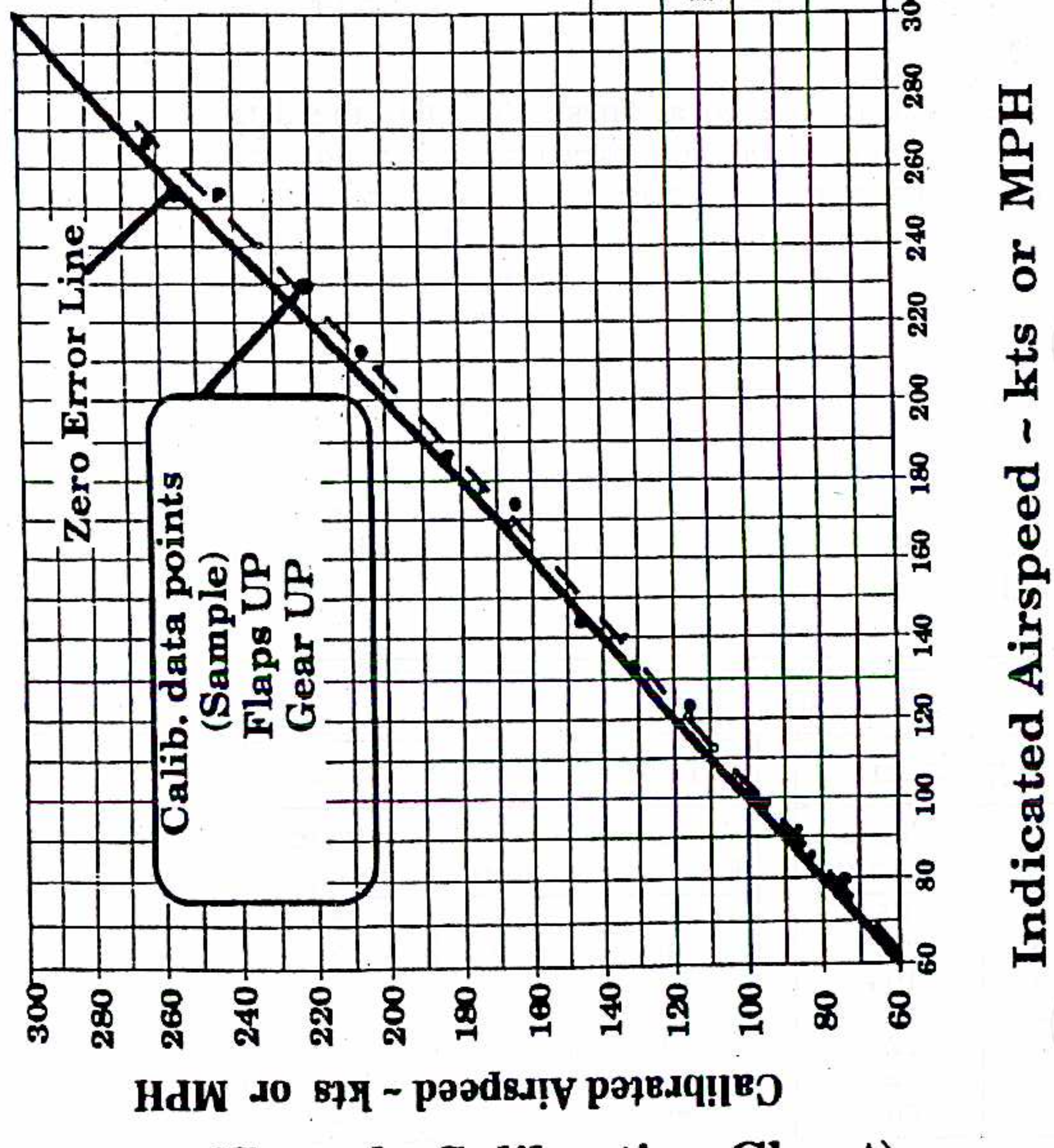
Landing Configuration		
For actual Kts / mph	Add	Indicated kts/mph
70	-5	65
80	-5	75
90	-4	86
100	-2	98
110	0	110
120	+3	123
etc.		etc.

Airspeed Calibration Data Samples

Airspeed Calibration

(Sample Chart)

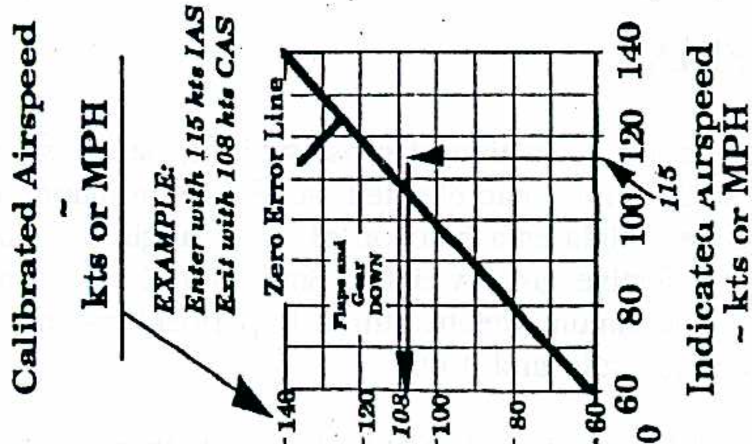


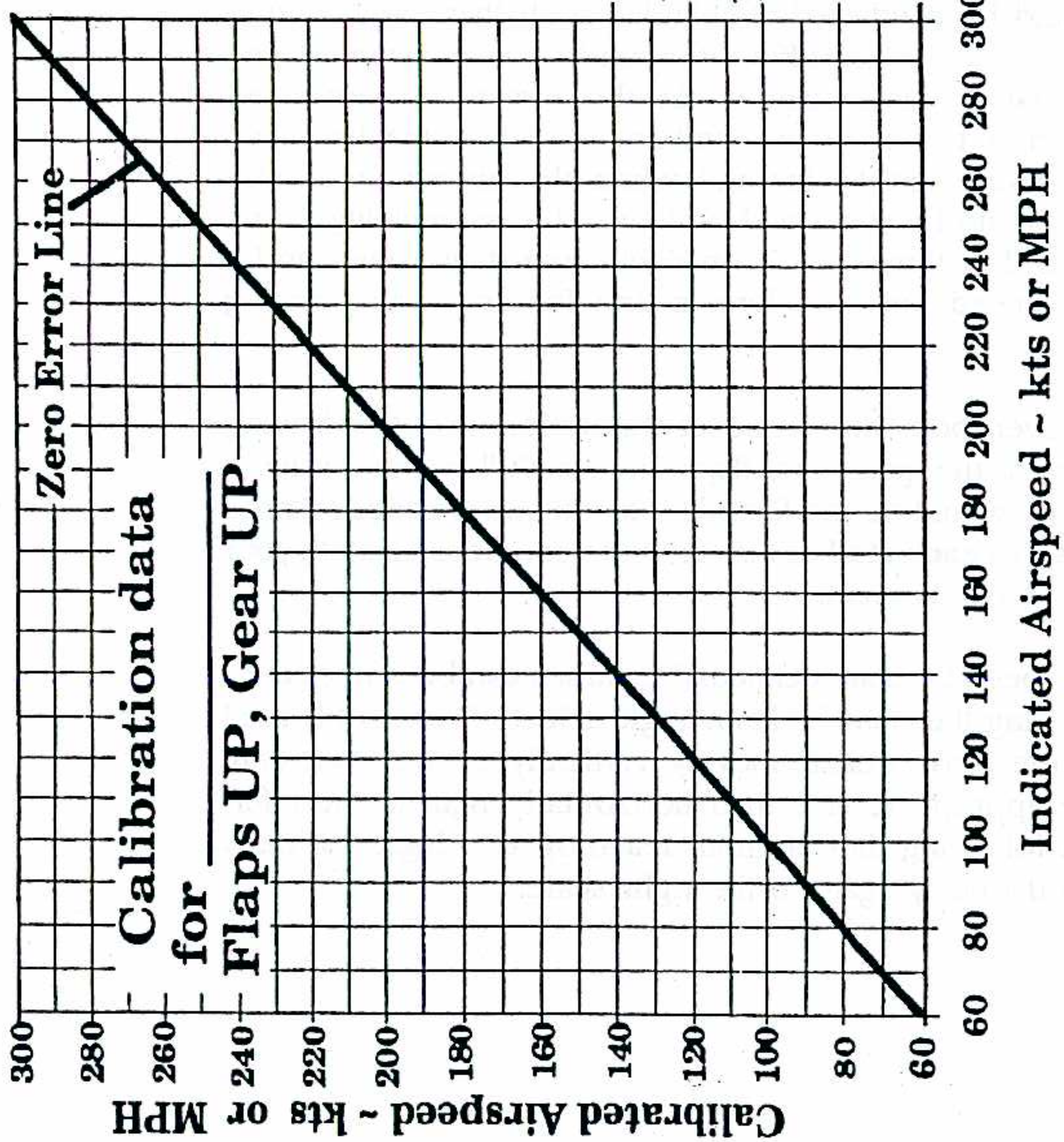


(Sample Calibration Chart)

AIRSPEED CALIBRATION for

____





Airspeed Calibration for ______________

(U.S. Example, N 9869R)

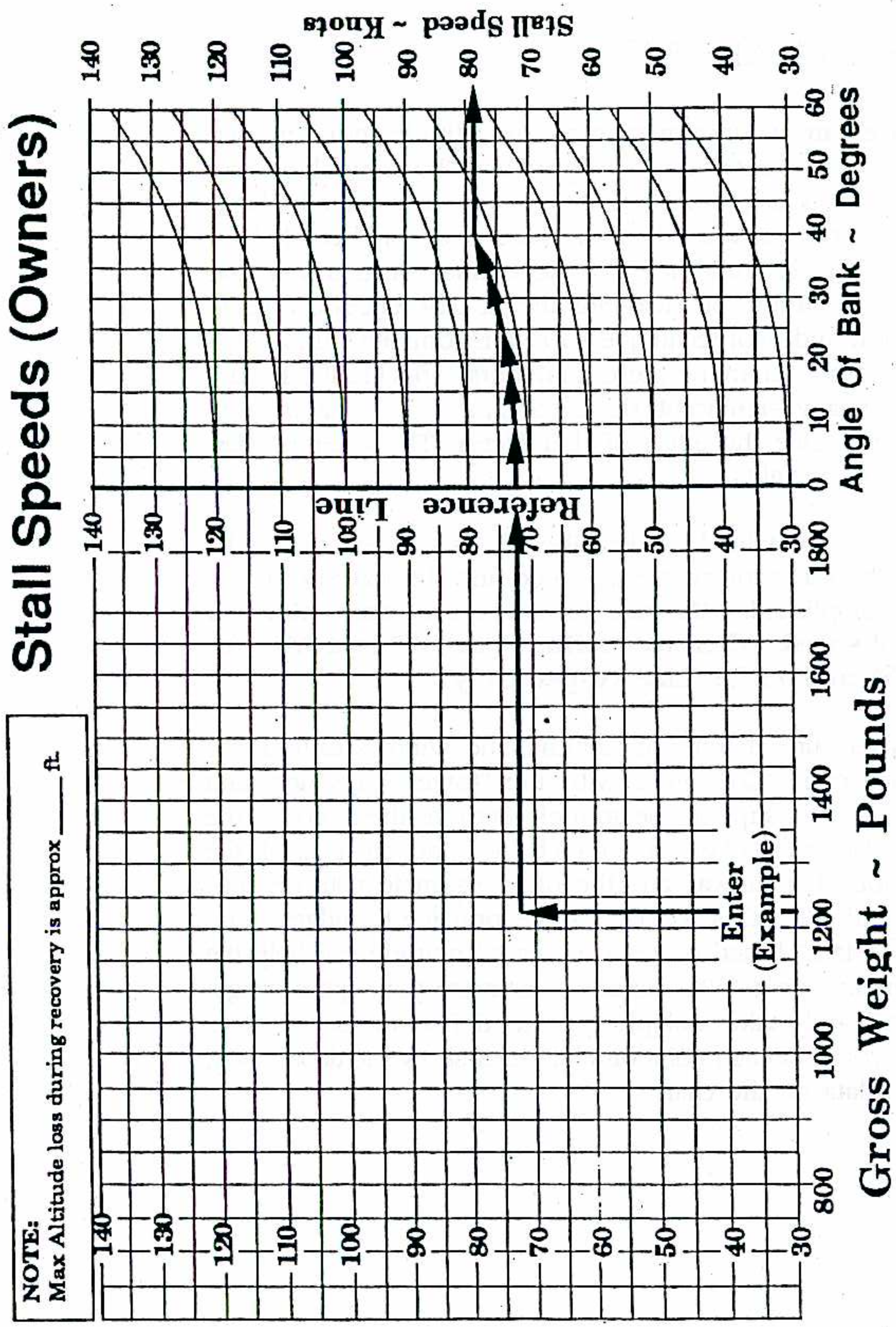
STALL SPEEDS

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 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 "Vr" and "Vy" for these tests (65 and 75 kts CIAS 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 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 Knots ~ CIAS Lift off	50Ft	Pressure Altitude Ft	0°C, (32°F) Ground Roll	Clear 50 Ft
1200	65	75	SL 2000 4000 6000		
1400	65	75	SL 2000 4000 6000		
1600	65	75	SL 2000 4000 6000		

Weight LBS	Takeoff Speed Knots ~ IAS Lift off	50Ft	Pressure Altitude Ft	20°C, (68°F) Ground Roll	Clear 50 Ft
1200	65	75	SL 2000 4000 6000		
1400	65	75	SL 2000 4000 6000		
1600	65	75	SL 2000 4000 6000		

Weight LBS	Takeoff Speed Knots ~ IAS Lift off	50Ft	Pressure Altitude Ft	40°C, (104°F) Ground Roll	Clear 50 Ft
1200	65	75	SL 2000 4000 6000		
1400	65	75	SL 2000 4000 6000		
1600	65	75	SL 2000 4000 6000		

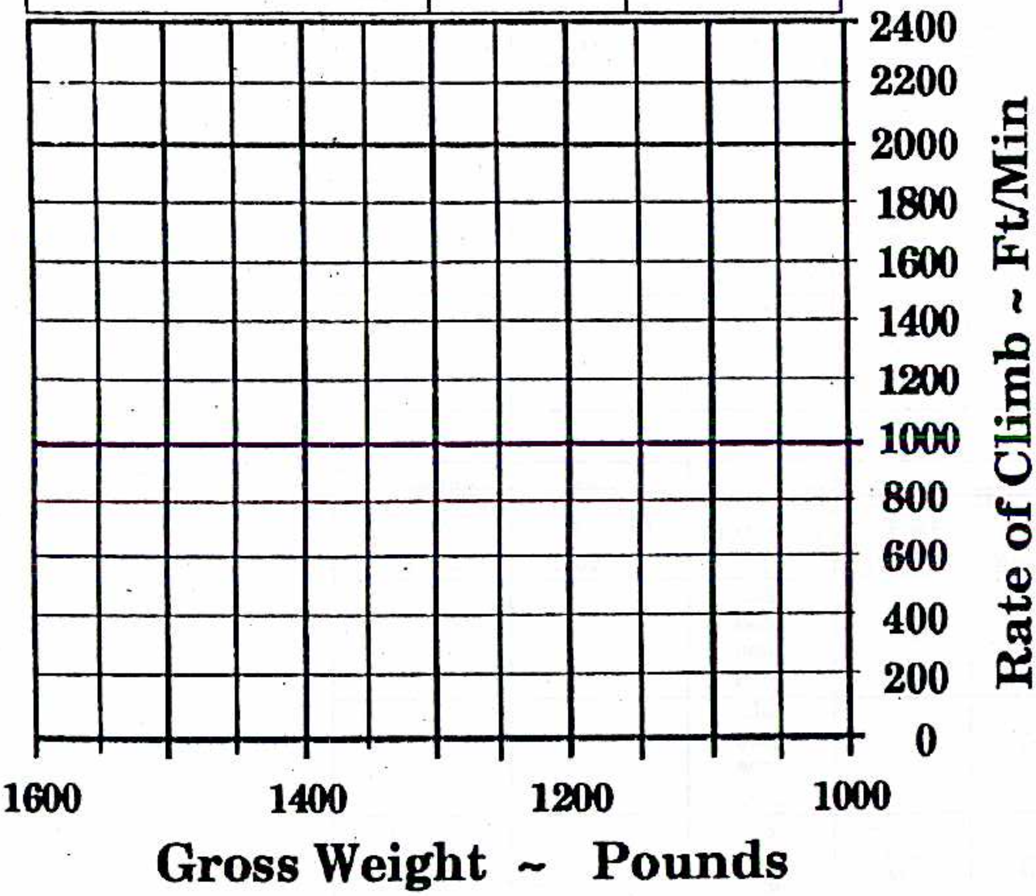
Take-off Distance Data for ________

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 125 kts IAS, with flaps and gear up. These 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	All	125 KTS



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

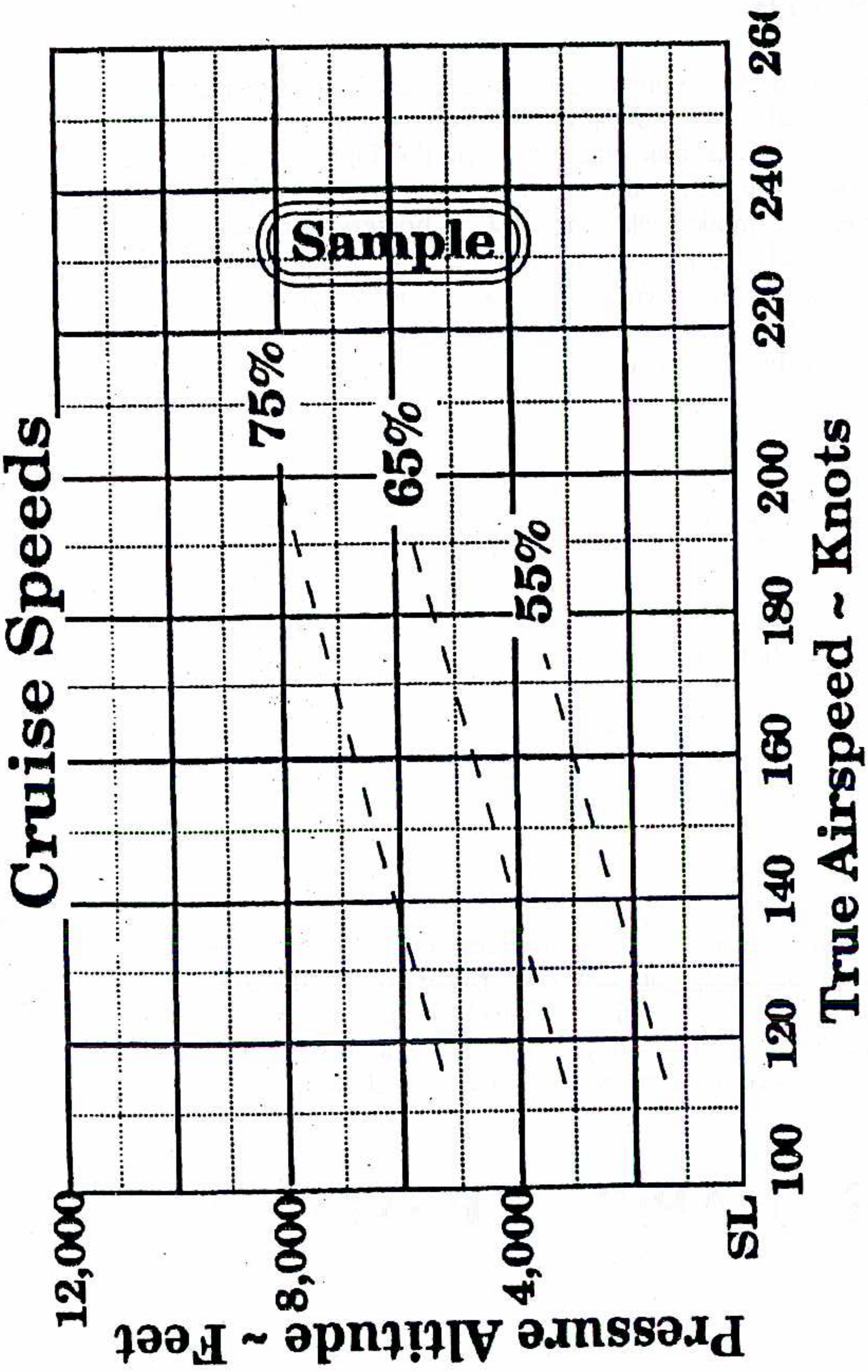
Several other charts of a general nature are included for your use. The aforementioned "Part Throttle Fuel Consumption" chart for one common engine is shown. If this is not your engine, your engine's manual will have a similar chart, and it is recommended that you include such a chart (photo reduced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

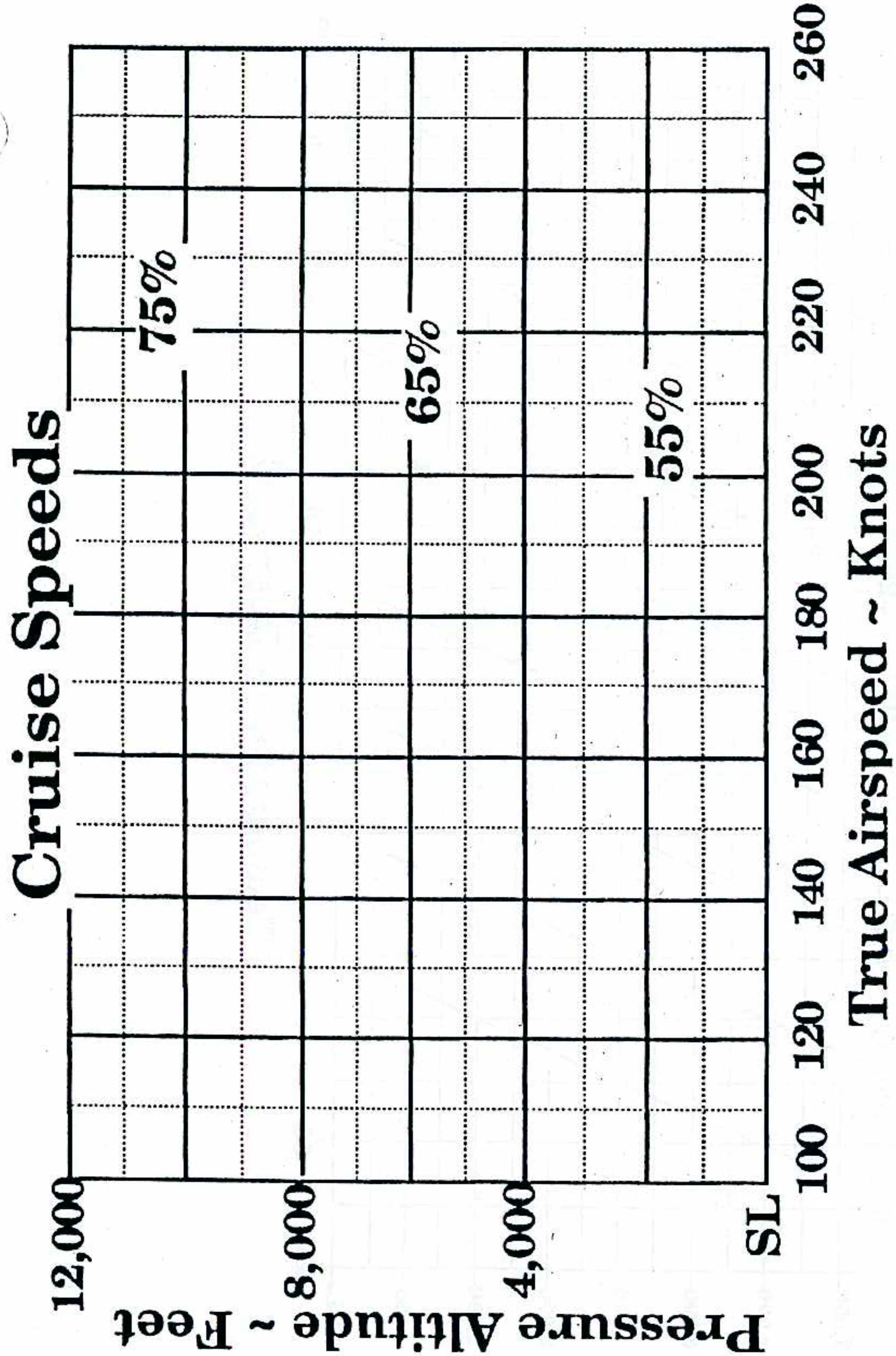
SUMMARY

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.

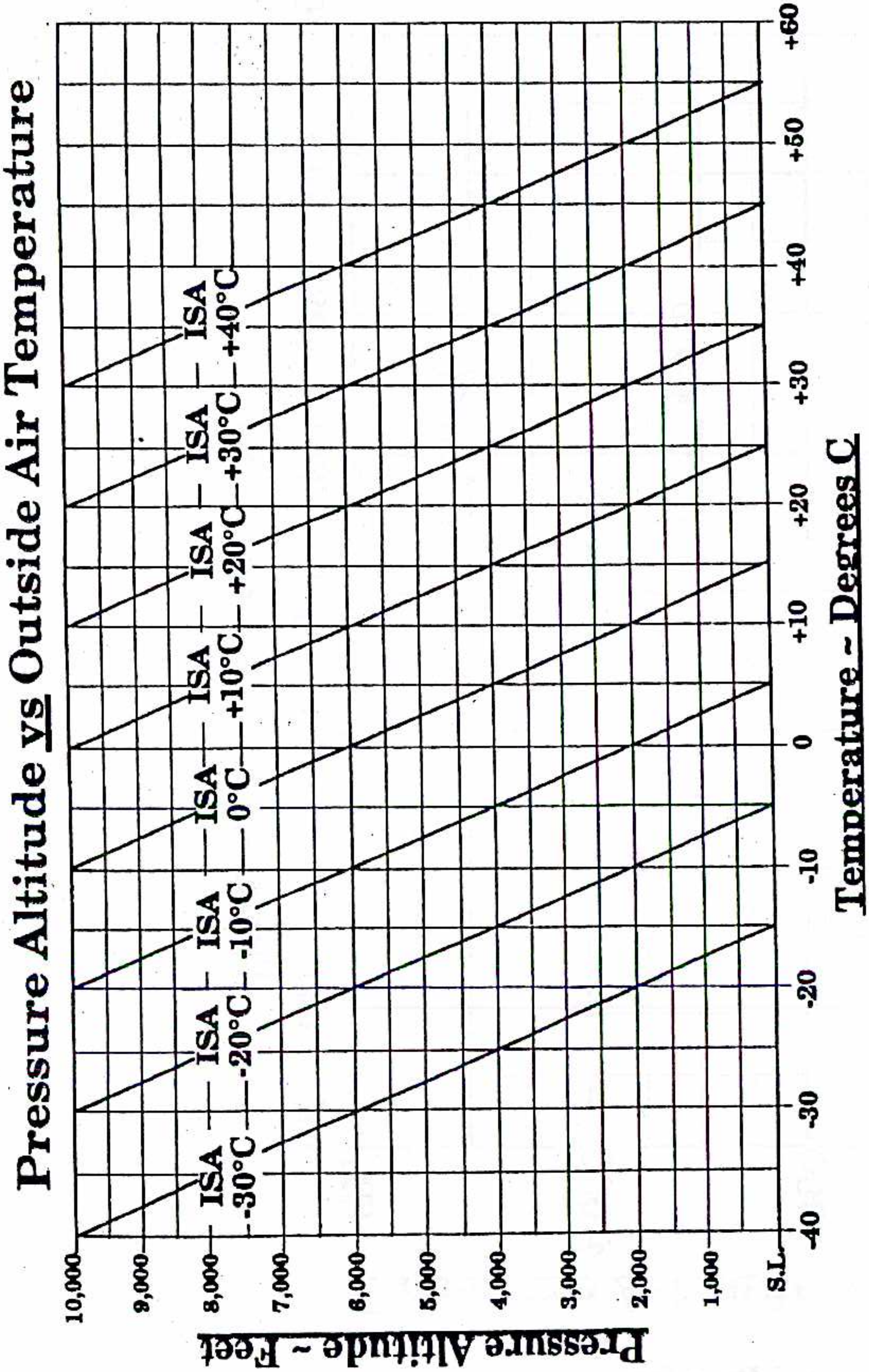
SAFE & HAPPY TESTING !



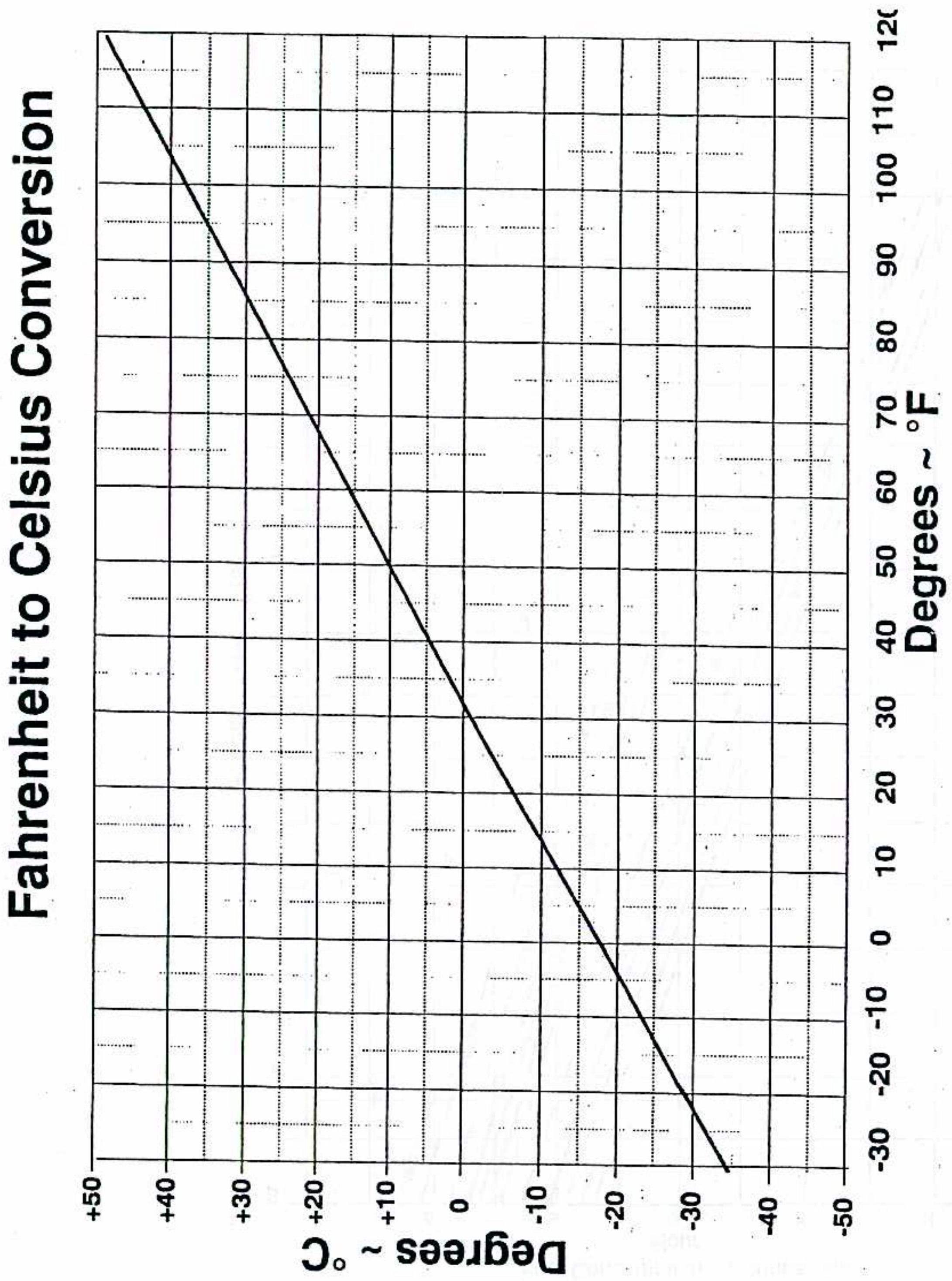
Sample Cruise Speed Data



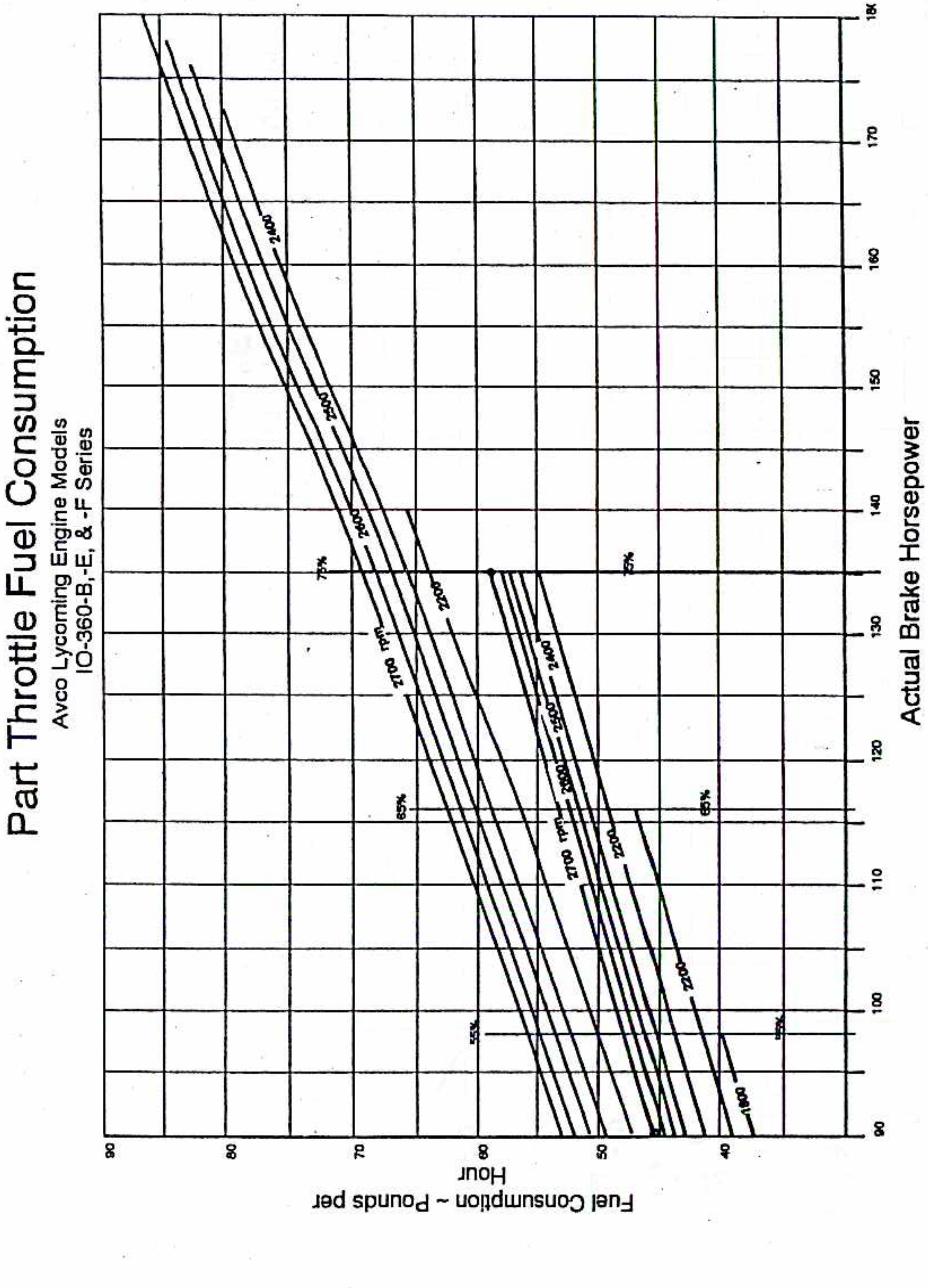
Cruise Speed Data for ______________



International Standard Atmosphere (ISA)



Temperature Conversions



Typical Engine Chart

NOTES:

NOTES:

Weight & Balance

Section VI

Table of contents

Intentionally Left Blank

GENERAL

Proper CG is absolutely critical to safe flight. This is where NO exceptions can be considered - you must verify that the center of weight is in the correct position and if it is not, you MUST correct it before flight.

Warning

Do not use bathroom scales to calculate the center of gravity as they are not sufficiently accurate. Flying outside of the approved center of gravity envelope is dangerous.

You should rent or borrow a good set of accurate beam scales or equivalent. These scales should be able to handle up to 400 pounds each. Often your local EAA chapter will have a set, or know the location of a set available for your use. Many FBOs have them also.

The allowable Center of Gravity range is FS 24.5 to FS 30.3 (15% MAC to 29% MAC)

AIRPLANE WEIGHING PROCEDURE

1. First establish the airframe's empty weight and its empty Center of Gravity (CG). The aircraft and the scales must be level while being weighed on the scales and preferably in a hangar with the doors closed to eliminate any wind effects. (If weighing outdoors, the wind must be virtually calm.) Shims (1 x 4s or similar boards) may be required under the main landing gear to establish this level attitude and these shims become part of the "tare weight". All tare weight is deducted from any scale readings.

NOTE

It is preferable to not have the battery installed at this point. This will allow you to calculate its optimum longitudinal position in the aircraft and thereby locate the final CG location. The battery position can be adjusted during the weighing process and its position established if time "on the scales" permits.

2. Establish a "datum point" from which ALL measurements can be made. For convenience, the back of the spinner is recommended.
3. From this datum point, drop a plumb bob and mark a point on the floor. Also mark an aircraft centerline on the floor. This can be done by also dropping a plum bob point from the tail and "chalking" a line between the two points. (The spinner CL will be slightly to the right of a true centerline, but will be close enough for the purpose of establishing the longitudinal CG.)
4. Drop a plumb bob from the center of each wheel axle. Mark the nose gear axle center onto the ground at the centerline position. Mark the two main gear axle centers on the ground and extend a straight line between the two main gear crossing the fuselage centerline previously, "chalked" onto the floor.
5. Read and record the actual weights of the leveled aircraft on the three scales. Log these weights in the appropriate lines on Column A. (See blank Lancair 320 "Weight and Balance Sheets" on pages 10 and 11 of this section, provided for recording these data. Several "Record" sheets are also included as well as an "Equipment List" for your convenience.)
6. Log the weights of any shim stock (the 1 x 4s and any other non-aircraft weight) that is on the scales as tare in Column B
7. Subtract the tare weights from the measured weights and place those figures in Column C.
8. Next measure and record the distance from the datum point to the location of the main gear as marked along the fuselage centerline. Log these distances in the appropriate lines of Column D, these are the "arms" or "moment arms".

You now have all the information required to establish the aircraft empty Center of Gravity.

MOMENT WEIGHTS

1. Now, to arrive at the "moment weights" of the nose gear and the main gear locations simply multiply the weight of the nose gear and main gear by the distance from the datum point, and record the values in Column E.
2. Total Columns C and E separately.
3. Divide Column E by Column C and the result is the empty weight CG expressed as a distance from the datum point.

This empty weight CG must ultimately be forward of the allowable flight CG range since when the pilot gets into the aircraft, he will be aft of this point and that will move the CG aft into the beginning of the allowable range. The empty CG should be such that the plane is in the most nose heavy condition (full header tank and just the pilot in the plane) i.e., the CG at the front limit.

NOTE:

The allowable Center of Gravity Range is Fuselage Station (FS) 24.5 to FS 30.3

Now locate the above locations so that you can reference your actual CG in meaningful terms.

There are two easy references: 1) the forward face of your firewall is FS = 0 and is easily located thru the nose gear well. Drop a plumb bob line down from that point and mark it onto the centerline of the floor. (This may be on the scales.) Measure from your datum point to this FS = 0 mark and record the dimension. Now calculate your particular moment arm required to align with FS 24.5 and FS 30.3.

Before removing the aircraft from the scales, it is wise to also establish your exact moment arms for various loading items such as header tank fuel and pilot/passengers. While the header tank fuel can be estimated with accuracy since it is a defined shape with known weights, the pilot and passenger moment arms are less defined and should be determined not estimated. They are affected by such as seat back angles, cushions, etc. which can easily change the aircraft's CG.

To determine your pilot/passenger moment arm have someone sit in the plane and log the resultant weight changes on the three scales. (You'll notice the nose gear scale weight is less while the main gear weights increase.) Now recalculate the pilot's moment arm.

EXAMPLE

Let's say you weigh 170 lbs. The net change on the nose gear was (-50#) and the net gain on the main gear was 220# (170 + 50). Multiply the nose gear weight change (a negative number) by its moment arm and the main gear weight change by its moment arm. Combine those two numbers (moment weights) and divide by 170. (Remember that the nose gear number is negative so it will subtract from the other.) The resultant figure is the moment arm for your body. Log that dimension as the pilot & passenger moment arms (assuming both seats are configured the same).

This approach can be used to calculate accurately any loading units like the header tank fuel, wing fuel, and baggage. It is recommended that this be done as this is the most accurate means of attaining a true loading analysis for your particular airplane. If you are measuring for fuel loads, accurately measure the gallons (use 6 lbs/gallon to calculate the weight) and/or accurately weigh the gallons as well as a double check and use the more accurate value. Oil weight is 7 lbs/gallon.

If you have the battery positioned in the aircraft the weights will be final and the aircraft's empty CG should be forward of the allowable forward CG limit. This is because virtually all flight load conditions will move the CG aft. It is ideal is to have the CG located on the forward most point of the envelope when you have a full header tank and only the pilot in the plane. This will be your most forward CG flying condition, all other loads only move the CG aft and as you use the header tank fuel the CG will also move aft. This is mostly effected by the pilot & passenger's moment arm. An empty CG about 2 inches forward (FS 22.5) is about right, but this should be verified for your aircraft.

CAUTION

Do not set the aircraft empty CG at the forward most point of the allowable CG range. This wastes available CG range and thus requires less loading to move the CG range to and beyond the aft limit which is very dangerous and an unacceptable condition.

As noted earlier establishing the battery location is the easiest way to adjust the CG to the desired location. This can be done by weighing the aircraft without the battery and calculating the best position for the battery. Time on the scales permitting, the physical location of the battery (and its box, master relay, installation brackets, hardware, etc.) can be double checked. Some compromise is generally required for the battery's position. Another example for these calculations is shown below.

SAMPLE CALCULATION

Battery Placement

1. Establish the battery weight including the master relay, battery box, etc. For this example 26 lbs is used.
2. The plane weighs 980 lbs (less battery) and its moment arm calculates to be 56, thus providing an FS 20 location (assuming a datum point that was 36 inches forward of FS 0).

We have calculated that an FS 22.5 empty CG position is ideal thus the goal to be attained. That will result in an ideal empty weight moment arm of 58.5 including the battery.

980 x 56 = 54,880	Moment weight (less battery)
980 + 26 = 1,006	Final a/c empty weight.
58.5	Ideal a/c empty wt. moment arm
1006 x 58.5 = 58,851	Ideal a/c final moment weight
58,851 - 54,880 = 3,971	Ideal bat moment weight
3,971 / 26 = 152.7	Ideal bat moment arm (FS 116.7)

3. Thus by the above calculations you would mount the battery at FS 116.7.

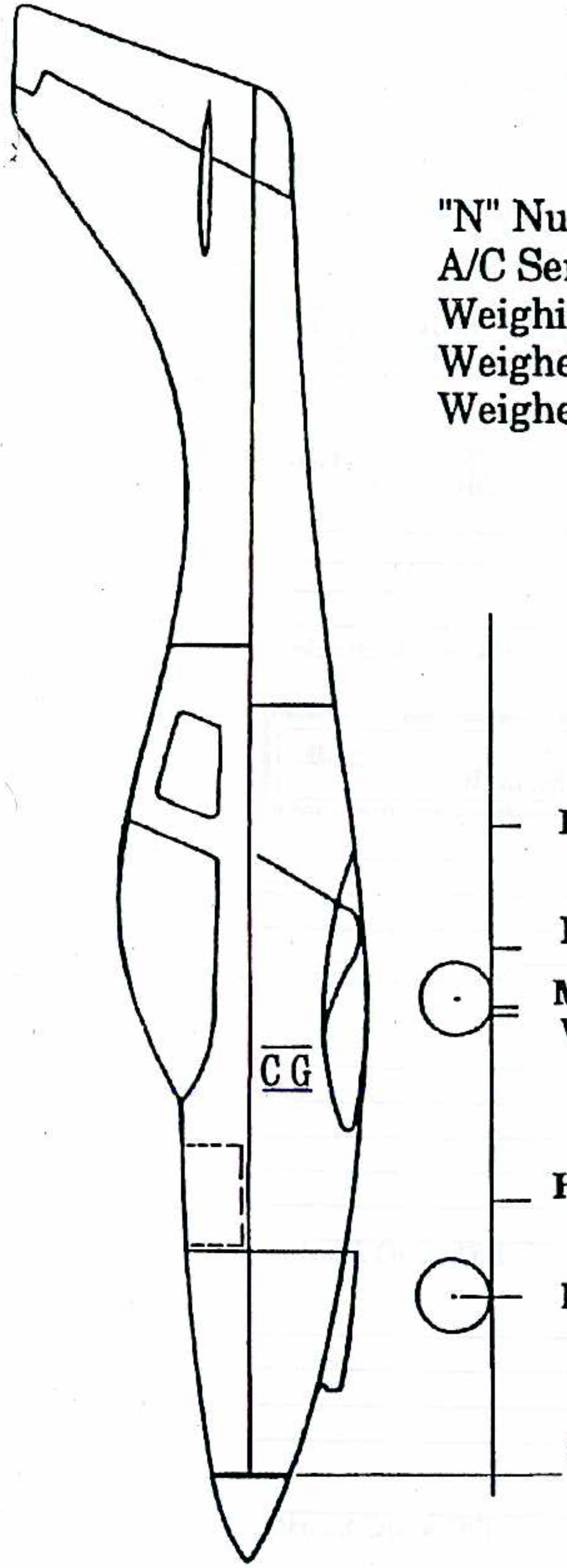
If you need ballast weights in the aircraft to achieve the proper CG try to use such required items as a tool bag. There are also ways within the engine compartment to change the weights by using a lighter or heavier starter or alternator. The last option is lead.

Several sample loading should be calculated to verify that you always remain within the allowable CG range. If there are loadings which result in a CG aft of the allowable location you must placard the plane accordingly. This is usually found as a baggage compartment limit. If a "hat rack" has been built in, it should be placarded for a maximum since it is so far aft. Generally, 3 to 5 lbs is the maximum for this location.

Included are several blank weight and balance sheets for your use. These should be filled in for typical loadings to verify that you will not be inadvertently loading the aircraft improperly.

Weight and Balance
Station Layout Data

"N" Number ______________
A/C Serial No. ______________
Weighing Date ______________
Weighed By ______________
Weighed at ______________



Station

Baggage ______________

Pilot & Passengers _____

Main Wheels __________
Wing Fuel ____________

Header Fuel ___________

Nose Wheel ___________

Suggested Datum Point, Station Zero (0 inches)

Basic Aircraft Station Layout

NOTE

The FAA regulations require that at least one aircraft weight and balance sheet be carried in the aircraft at all times.

Weight & Balance SHEET, 235, 320, 360
(Circle One)

"N" Number__________
Builder__________
____

CG Range: (Inches) 5.8
FS 24.5 to FS 30.3

	A Wt.(lbs)	B Tare Wt.	C Net Wt.	D Mom. Arm	E Mom. Wt.	Sta.
Nose Gear						
Rt. Main						
Lt. Main						
Empty CG (with oil)						

E/C = A/C Station

	C Net Wt.	D Mom. Arm	E Mom. Wt.	Sta.
Plane				
Pilot only				
Header Tank Full				
Max fwd CG condition				

E/C = A/C Station

Plane				
Pilot & Passenger				
Low Header Tank fuel				
Wing tanks full				
Luggage				
Max aft CG condition				

E/C = A/C Station

Plane				
Pilot				
Fuel (header)				
Fuel (wings)				
Luggage				
Sample Condition				

E/C = A/C Station

Weight & Balance Data Sheet

Weight & Balance RECORD

Lancair model ______ Serial Number ______ Page Number ______

Date	Item No.		Description of Article or Modification	Weight Change						Running Basic Empty Weight	Running Basic Empty Moment
				Added (+)			Removed (-)				
	In	Out		Wt-#	Arm-in.	Moment	Wt-#	Arm-in.	Moment		

Lancair model ______ Serial Number ______ Page Number ______

Date	Item No.		Description of Article or Modification	Weight Change						Running Basic Empty Weight	Running Basic Empty Moment
				Added (+)			Removed (-)				
	In	Out		Wt-#	Arm-in.	Moment	Wt-#	Arm-in.	Moment		

Weight & Balance LOADING FORM

Basic A/C Empty Wt. ______________________
Empty Moment __________________________

Occupants		
Weight	Pilots ARM	Moment Arm
120 lbs		
140		
160		
180		
200		
220		

Fuel Gallons*	Header Weight	ARM	Wings ARM Moment
5	30 lbs		
10	60		
15	90		
20	120		
25	150		
30	180		
35	210		
40	240		
45	270		
50	300		
53	318		

* U.S. Measure

Baggage	ARM	Moment
20 lbs		
40		
60		

T.O.Wt. _____, **Moment** ________, **Station** _____
Acceptable Wt/Sta, ______________/______________

My Aircraft's Equipment List

Lancair Model 235, 320/360 (Circle)

Serial Number ________ Registration No. __________

Date __________

(Add new date on next line when adding/removing equipment.)

Item No.	Item	Mark √ If Installed	Arm (Inches)	Weight (lbs)

NOTES:

NOTES:

System Descriptions

Section VII

Table of Contents

Intentionally Left Blank

GENERAL

Having constructed your Lancair from either a standard or a Fast-Build kit, you are probably quite knowledgeable of its general construction and physical characteristics. Herein are included general systems descriptions applicable to all airplanes. 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.

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 320 wings are fabricated of high temperature prepreg E-glass skins over a high temperature Divinycell or Nomex honeycomb core. The wings, empennage and fuselage major parts are oven cured at 250°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.

FLIGHT CONTROLS

NLF(1) - 0215F airfoil (a) f-0°

The Lancair 320 is conventional in its control configuration. As with some other aircraft its modern Natural Laminar Flow wing airfoil is a NLF(1)-0215F design. This allows the use of flap positions from -7° to +45° (+25° for the Lancair 235) for cruise to landing flap positions. (The 320/360 wing is reflexed, therefore faired is essentially -7°). 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 push-pull tubes also with rod end bearings.

Trim Controls

Aileron trim is provided via a fixed trim tab on the right or left aileron. During your initial flights you will determine which wing is "heavy". This heaviness is generally due to minor variations in wing incidence from left to right and is normal for almost all aircraft including the Lancair. A tab, 5/8 inches (chord) by 4 inches (span), with a maximum of 20° deflection should be the largest required. It is placed on the lower side of an aileron such that it tends to move that aileron up to provide the required trim. Adjustments to this tab to eliminate any wing heaviness during flight should be made only when equal fuel is in each wing. Subsequent to this adjustment, alternating the wing fuel quantity using the fuel pumps to transfer fuel to the header tank will maintain this trimmed condition. An electric roll trim option is available.

Rudder Trim

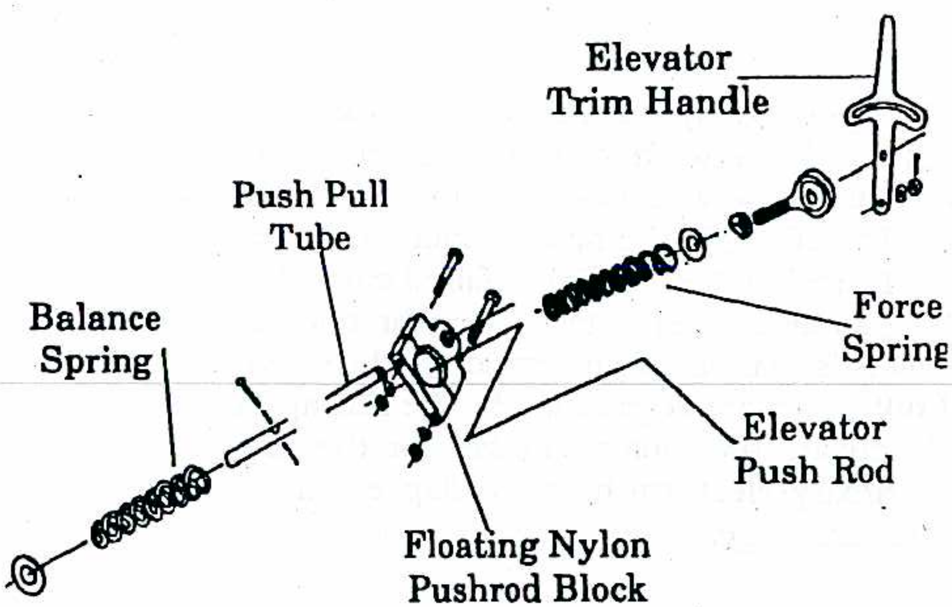
The Lancair can also be fitted with a fixed rudder trim of the same design as used on the aileron. This tab again should be adjusted such that at your normal cruise condition (power and altitude) the "ball" is centered.

NOTE

Some builders have installed manual or power rudder and/or aileron trim systems. When such a system(s) is installed an item should be added in the pre-takeoff check list to center or adjust the trims to a takeoff position.

Elevator Trim

The Lancair is fitted with a simple and effective system to trim the pitch forces out of the control system. The preferred (over a servo control) system is a manual one where a spring force is added to the elevator control push-pull tube. The exploded view shows the simplicity of the system. The "indicator" showing the trim condition is located in the center console. The lever arm is moved forward or aft to apply the spring force on the forward elevator push-pull tube. As with the aileron trim, this will require flight tests to define the proper position and markings accordingly.



Elevator Trim Control

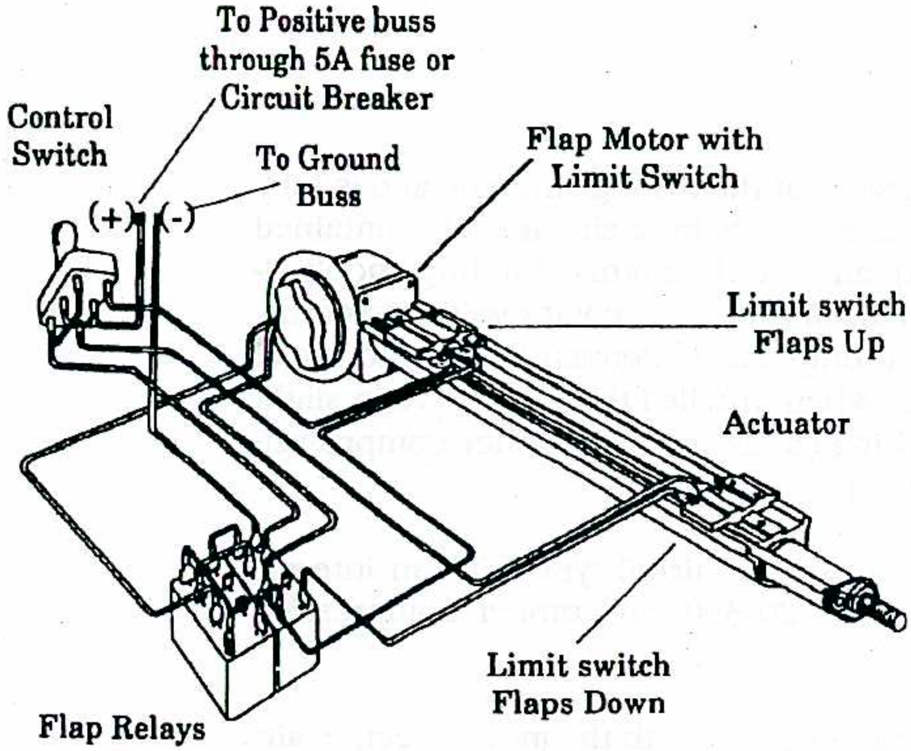
GROUND CONTROL

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 five inch wheels with Lamb tires on the main and nose gear. These tires are essentially scaled down "500x5" tires and generally should be operated on hard surface airports or smooth sod. A larger tire installation is under development.

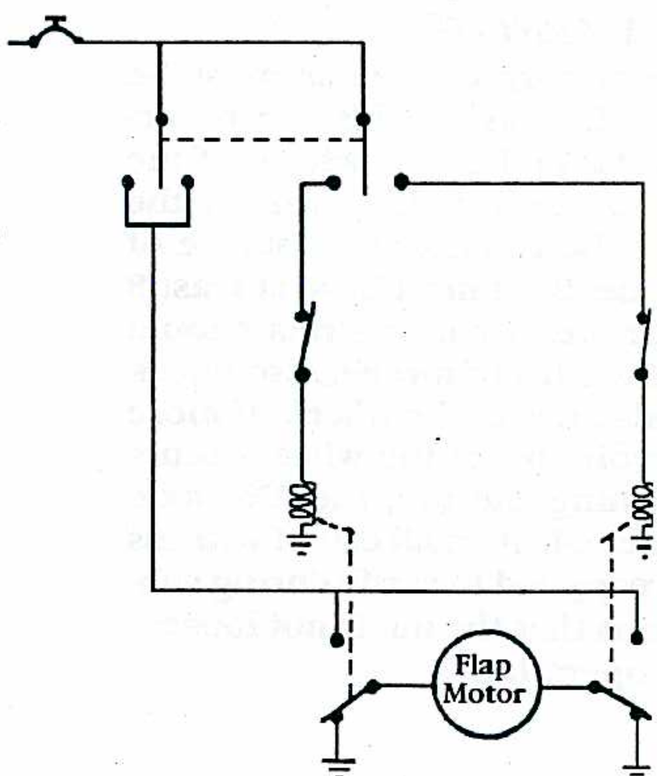
FLAPS

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. On the Lancair 235, the flaps retract to -7° for "full up", whereas on the Lancair 320/360 this is a faired condition due to the design of the 320 airfoil. 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 landing gear is of the trailing arm type and is fully retractable. Operation of the gear is by a simple, self contained hydraulic system driven by an electric motor. Landing shock attenuation is accomplished by means of a compression assembly consisting of rubber disks (compression donuts) bonded to metal spacers on the main gears. When installed these disks are in slight compression. Upon absorbing shock they are further compressed and absorb the landing impact.

The retractable nose gear strut is an air/oil type with an internal shimmy dampener (for Model 320/360) and rubber compression style on the Model 235.

As an option, Model 235s can be fitted with the more effective air/oil oleo style nose strut providing superior landing and taxi operations.

WARNING

The nosewheel shimmy dampener must be checked on a regular basis. This can be accomplished by holding the nose wheel off the ground (having someone hold down on the tail) and measure the rotational resistance of the assembly. Model 235s must have at least 8 to 10 ft-lbs of torque. Air/oleo struts should have from 20 to 50 ft-lbs of torque. Also check the rotational resistance of the wheel. If more than one free revolution of the wheel occurs upon firmly spinning the tire, the AN4 axle bolt must be tightened. A small dab of witness paint should be reapplied to verify during subsequent inspections that the nut is not loosening during flight operations.

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.

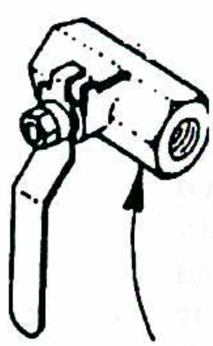
WARNING

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.



Note:
This valve is located under the instrument panel on the left side of the center console. 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 landing gear doors are mechanically linked to each gear and as such should not require adjustment. 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 of 122 kts (140 mph) 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 chaffed lines, leaks, bent arms or any excessive wear anywhere in the system should be corrected promptly to preclude more serious problems.

NOTE

Early model hydraulic pumps (round metal reservoir) require the filler port to be left 1 to 1 1/2 turns loose for proper venting.

BAGGAGE COMPARTMENT

The baggage compartment is located directly behind the passenger seats. Its capacity is noted on a placard but should never exceed 50 pounds for the Lancair 235 or 60 pounds for the Lancair 320/360. The aircraft weight and balance may limit the maximum baggage to less than the maximum stated herein. A "hat shelf" may also be installed, and if so it is limited to a maximum of 5 pounds due to its significant effect on the CG.

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 Lancair is fitted with seat belts and hopefully shoulder harnesses. The seat cushions are used to fit you into the plane and thus 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 don't. As with a 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.

DOORS, WINDOWS AND EXITS

Your Lancair is fitted with a canopy hinged with a parallelogram mechanism. It lifts up and forward providing clear access to the cockpit from either wing. The weight of the canopy is offset by springs which make it virtually weightless. It is secured in position by four latches with over center latches each with a safety to prevent inadvertent opening. A lock can be located on one or both sides of the canopy at the mid canopy frame position. A second type, forward hinge canopy system, is also available as an option. It will typically have two similar latches toward the rear of the canopy side rails.

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

Ingress and egress 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 Lancair is the use of a seat belt secured over one or both of the control sticks. 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 tiedowns 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 235 is generally fitted with a Lycoming engine of 118-135 HP, and a wooden fixed pitch propeller. With this powerplant it is one of, if not the most efficient aircraft in the air today. The 320/360 with their larger engines (160 to 180 HP) and controllable or constant speed propellers represent a logical extension of the 235 resulting in a superb cross-country aircraft.

These engines are FAA certified aircraft powerplants of 4 cylinder opposed, air cooled design provided with magnetos for ignition, a starter and generator. 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.

Engine Controls

There are basically two variations to these engines. They can be fitted with carburetors or fuel injection, and they can utilize fixed pitch or controllable pitch propellers. Four controls are provided for engine operation as generalized below. You should know your particular system and its operation.

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. An rpm drop of approximately 100 rpm will be experienced from moderate power settings (≈2000 rpm) when operating on only one magneto. The engine speed variation between left and right mags should not exceed 50 rpm. 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, resulting in maximum power output.

Controllable propeller engines also have a prop control which controls the engine rpm 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 accomlished in accordance with tthe 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 rpm 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 four. 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 aircrafts 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 exhauating 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

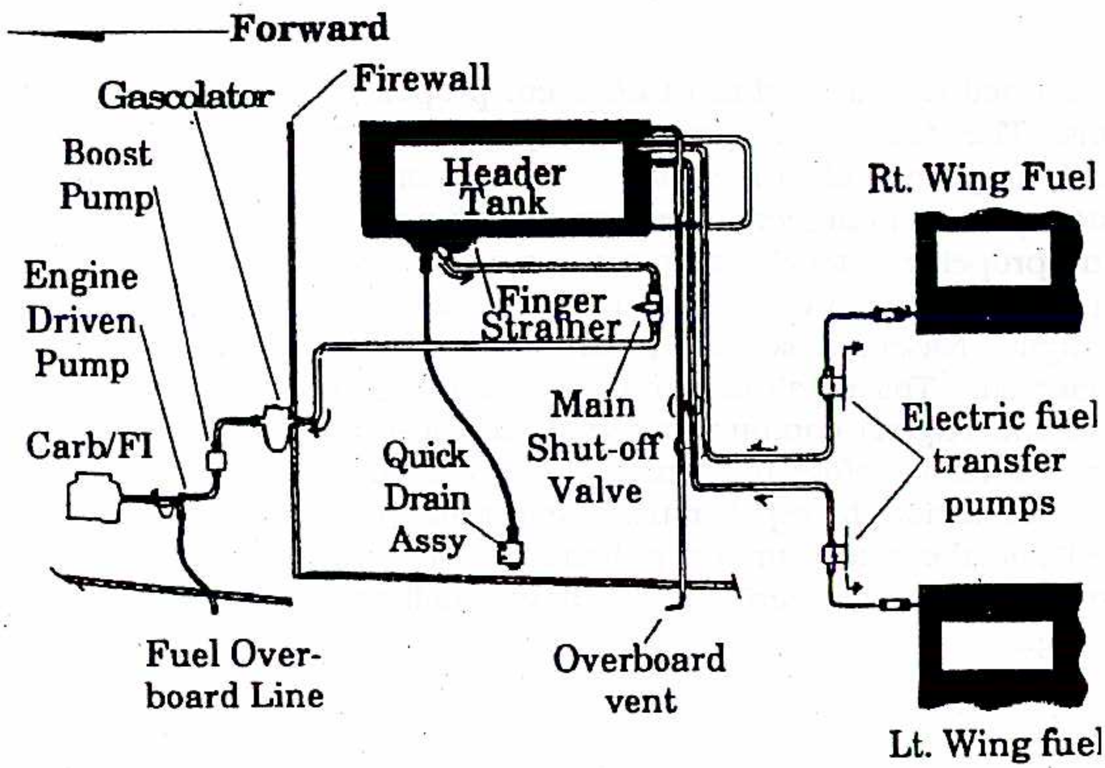
After a few hours of operating your Lancair you will become familiar with its operation from its flight controls to the engine. It is good practice to make written notes of how it is operating so that you can spot changes. These changes may be toward stabilizing or deteriorating indications and heed 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 a number of different propeller/ engine combinations. The Model 235 is generally equipped with a wooden, fixed pitch propeller while the 320/360s use a constant speed type. The latter provide improved takeoff and climb performance. 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 header tank located forward of the instrument panel and aft of the firewall. It feeds fuel to the engine pump thru a fuel filter and a gascolator. The header tank is in turn fed independently from either the left or right wing tank by electrically operated fuel pumps. Each wing tank has a filter at its outlet and the fuel is pumped directly into the header tank. Aircraft with the extended tank option simply have another bay of fuel outboard of the normal tank which is integral with the normal tank. The fuel transfer pumps are independent and pilot operated. In the basic system the pilot uses the pumps left and right to maintain roll trim. Care needs to be used to preclude overfilling of the header tank as that fuel is simply forced out the vent and overboard. A light or gauge can be installed to indicate the status of the header tank. The figure on the next page shows a schematic of the fuel system.

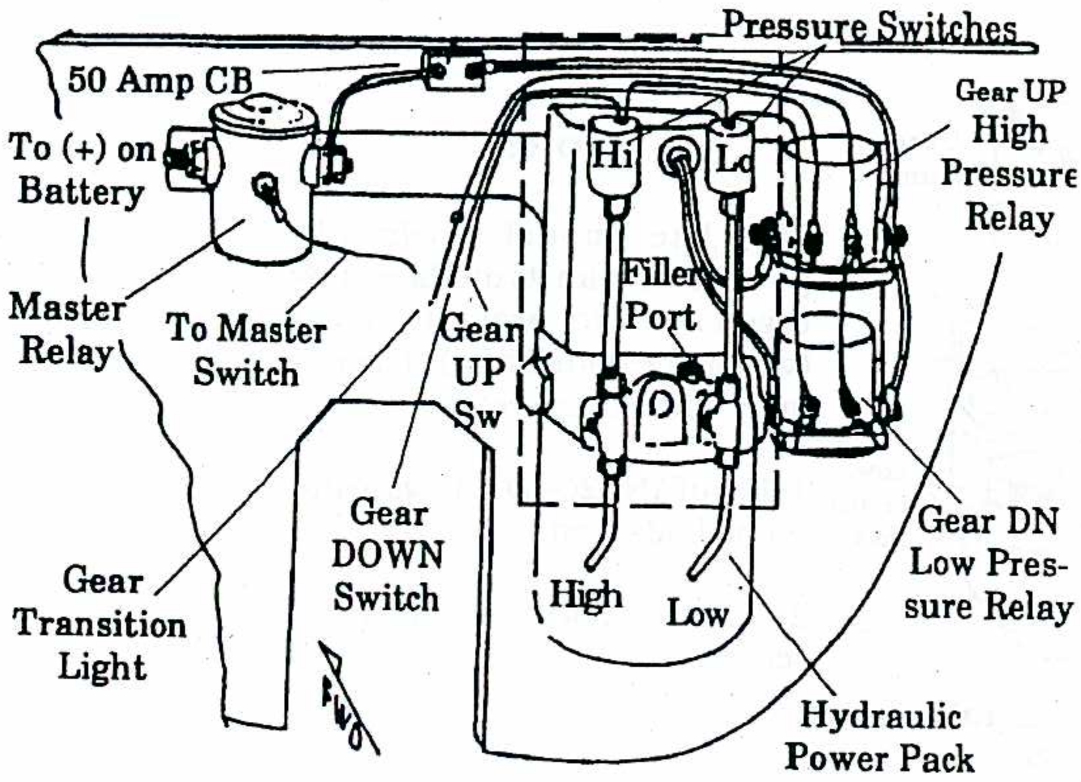


Fuel System Schematic

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.

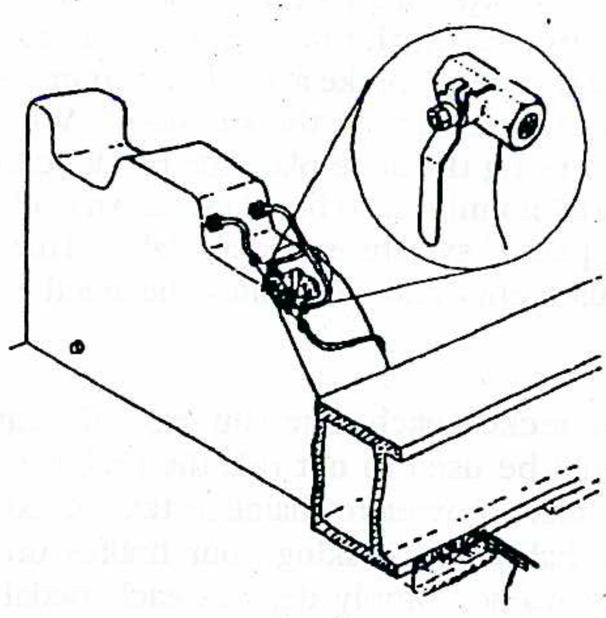
As with any hydraulic system proper servicing is required. Use only MIL-H-5606 "red" hydraulic fluid, and remember that with hydraulics, cleanliness is next to godliness. A schematic of this system is shown.

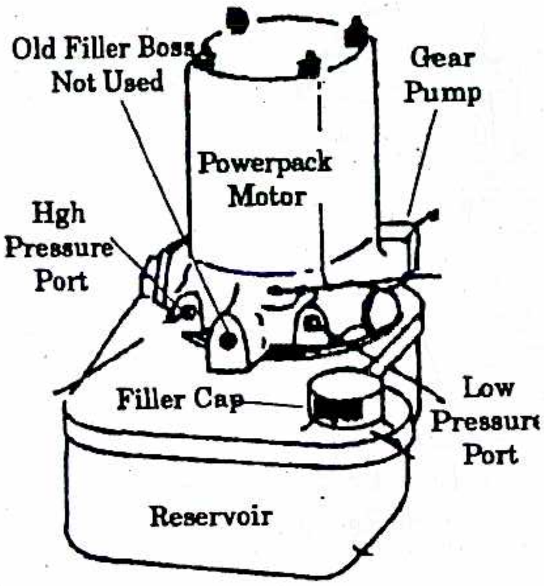


"Original"

Hydraulic Power Pack Installation

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 generally located just forward of the instrument panel center console area on the left side by the nose gear tunnel.





Late Model Hydraulic Powerpack

Note:

The late model hydraulic powerpack with its modified reservoir on the previous page (within the dotted box). The primary differences are:

1) Use of AN 826-4D fittings in the pump body, and

2) Relocation of the complete assembly.

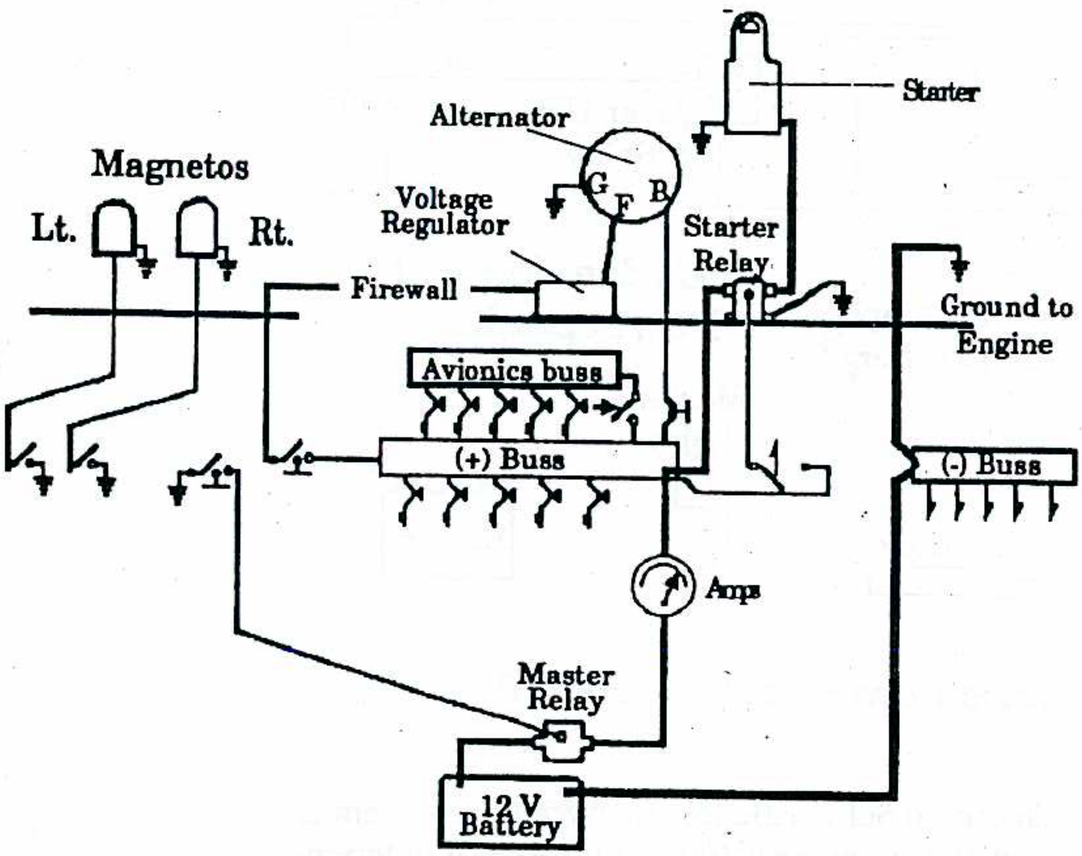
BRAKE SYSTEM

The Lancair brake system is installed on the pilots (left) side. Steering of the aircraft on the ground is by use of differential brakes. The rudder pedals incorporate independent toe brake cylinders operating the disk brakes on the main gear. If adjustable rudder pedals are installed the pedal/brake assembly is mounted on a slide plate which is adjusted relative to the sub floor. When the pedal position is adjusted using the slide plate the rudder cable adjusters (perforated metal strips) must also be adjusted. An optional "adjustable brake/rudder pedal" system is also available. This unit greatly simplifies the adjustments and eliminates the need to adjust the rudder cables.

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.

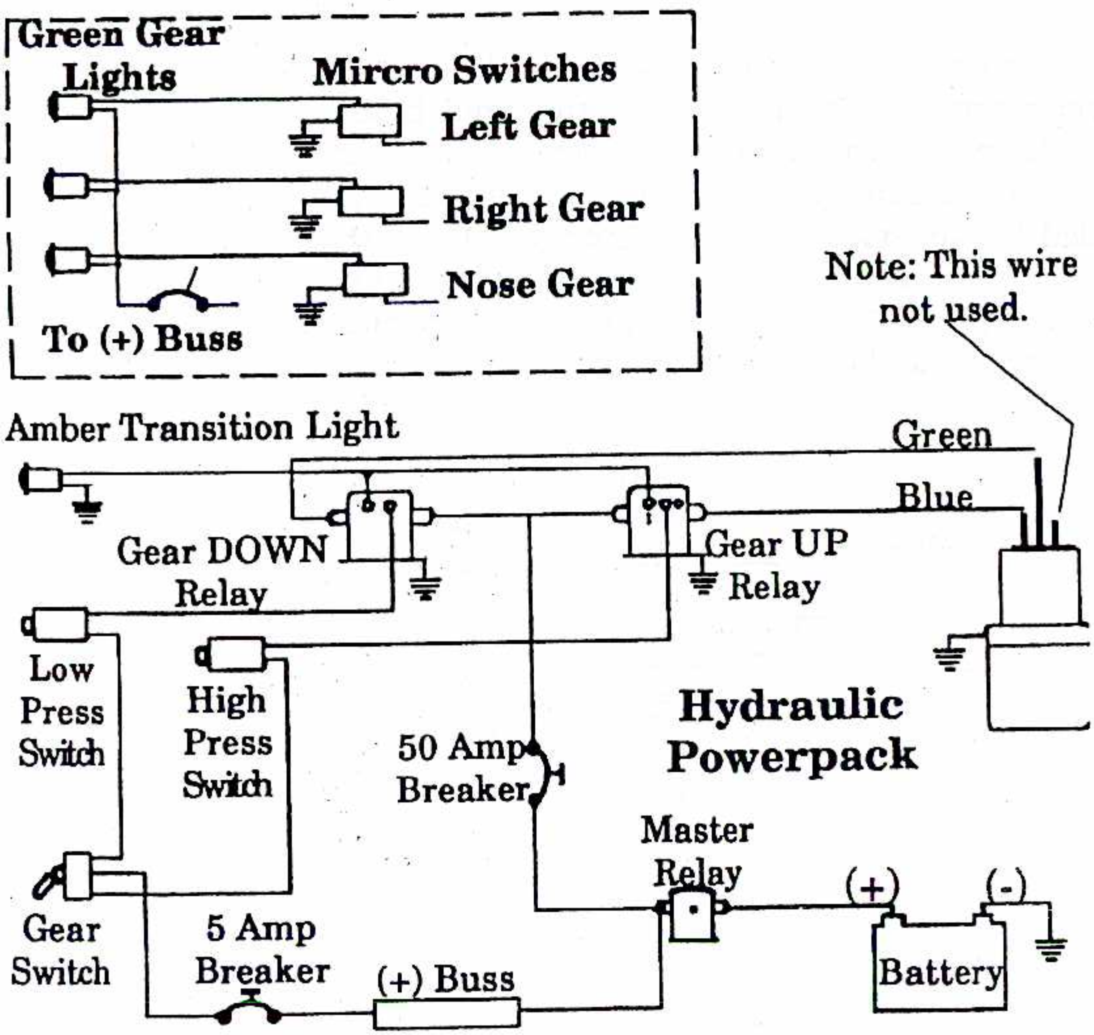
ELECTRICAL SYSTEM

The Lancair basic electrical system consists of an alternator, a voltage regulator and a battery. This is shown in the figure below. 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.



Basic Electrical Schematic

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.



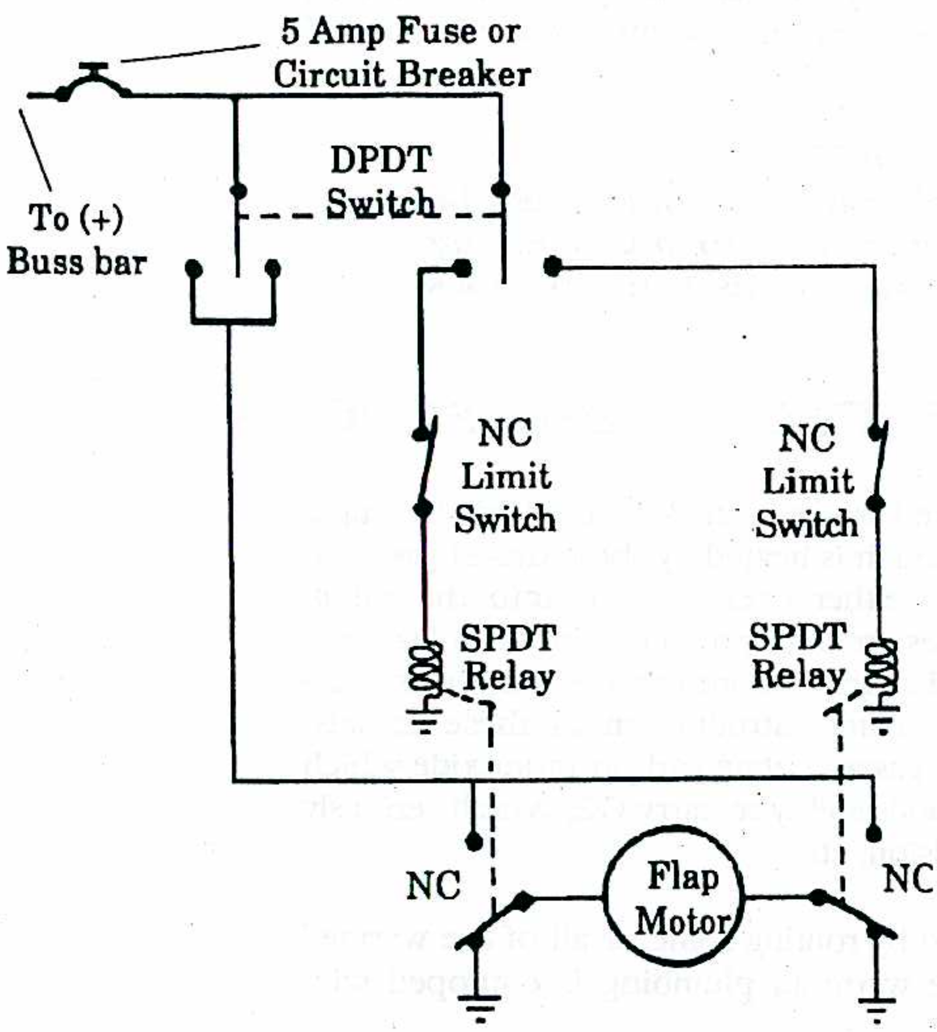
Hydraulic Power Pack Electrical

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.

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 (on Model 320/360 and in the lower console on Model 235s). 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 approximately 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 bloods 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, all latches must remain locked, the exception being on final approach for an emergency landing when rear latches only can be released. (See Emergency Procedures, Section III.)

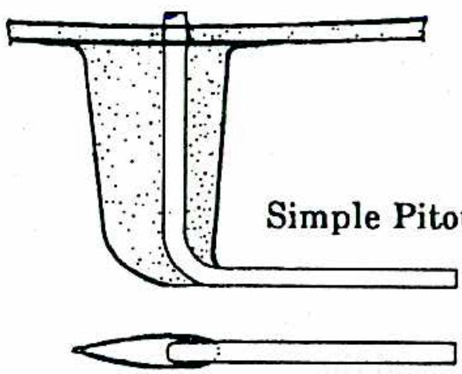
PITOT PRESSURE SYSTEM

The Lancair can be fitted with a standard heated pitot probe or an owner constructed probe (unheated). These are shown below. They are typically located on the lower side of the right wing. If your flights have the potential of below freezing temperatures, IMC conditions or precipitation the heated type should be installed and a check made of its operation prior to flight.

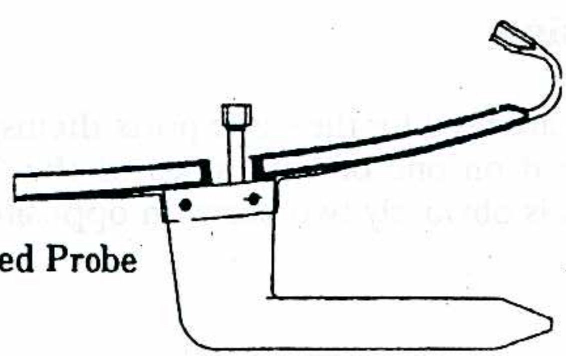
This check can be made during preflight by turning the master switch on, the pilot heater power on for a few seconds (less than 10 typically) and then feeling the probe for warmth. The preflight should also check that the probe opening has not become home for a wasp and that any cover has been removed.

NOTE

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



Simple Pitot Probe

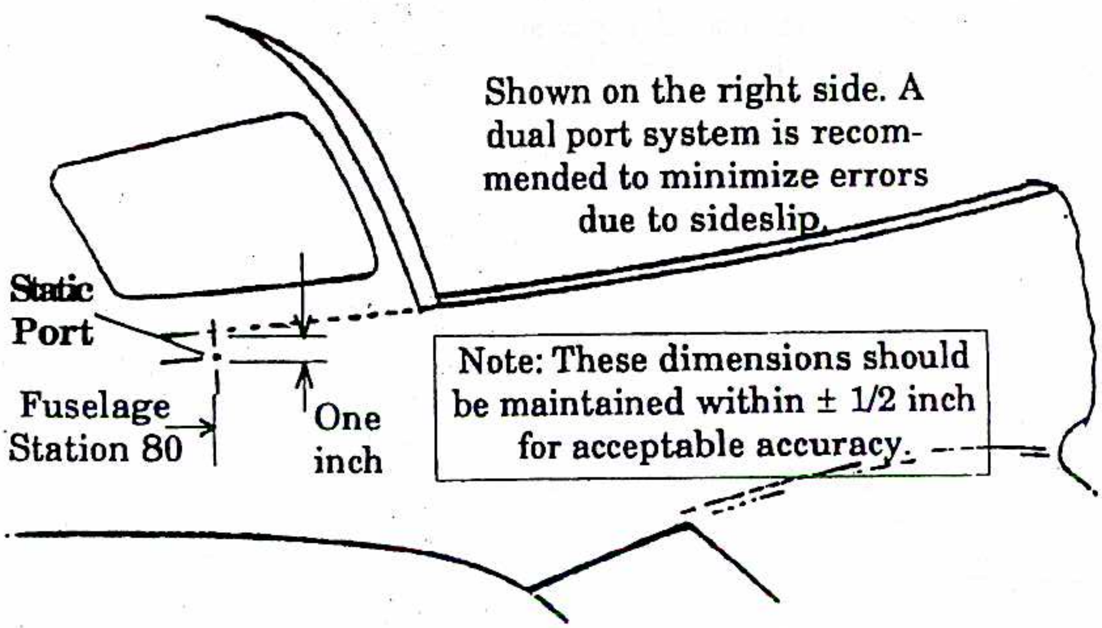


Standard Heated Probe

STATIC PRESSURE SYSTEM

Static Port Location

The static port location is as shown in the sketch below. If the aircraft has been outdoors for some time the preflight should check for cleanliness. (It should be flush, round and square with the fuselage and be a sharp edged hole.) If a static drain exists and the plane has been exposed to rain the drain should be checked to preclude water in the system which will introduce error into the altimeter and airspeed system.

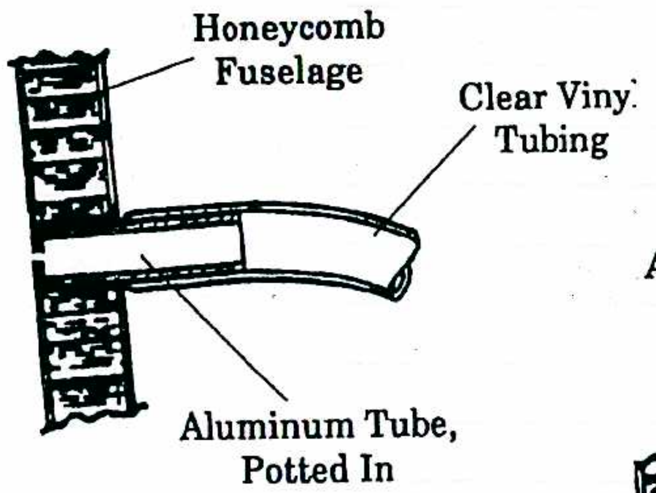


Static Port Location

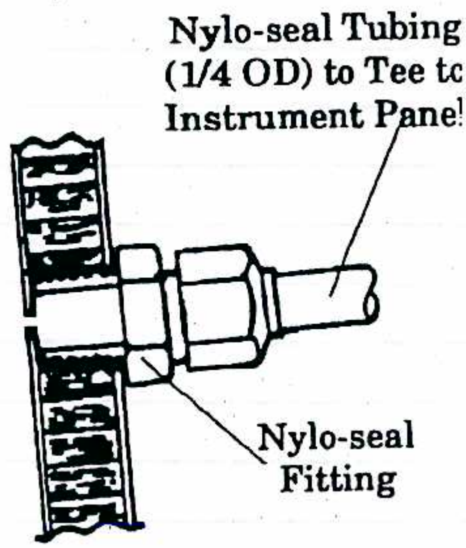
Static Port Design

Two arrangements are used for the static ports themselves and the ports can be located on one or both sides of the fuselage. The better arrangement is obviously two ports on opposite sides as the effects of yaw are reduced. The port(s) can simply be holes in the fuselage wall shown below as the "simple" design, a fitting thru the wall as shown below as the alternate design, or even a multiple hole commercially available port as found on many production aircraft (not shown).

Simple Port Design



Alternate Port Design



Static Port Installations

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.

NOTES:

NOTES:

NOTES:

Handling, Servicing, & Maintenance

Section VIII

Table of contents

Intentionally Left Blank

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/all 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 we hope that you keep good track of bills showing that 1)-You bought the parts and they were shipped to you. 2)-Pictures of you in the process of building the machine are considered mandatory by some agency personnel, and the more the better. Be sure to date each picture, adding some ID as to which part of the builder's manual being worked. Finally 3)-A notebook (preferably bound) log of your building process is recommended. This log should contain your hand written day-by-day description of work performed. References to the builder's manual section should be included and the pictures posted in this 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 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 "Annual 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.

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

Built in 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

The aircraft can have one wheel raised by jacking. Care must be used to prevent damage to the landing gear doors. A scissors or "bottle" type hydraulic jack is recommended. An allowance must be made for the compression pads to extend the wheel to its limit. At this point the wheel may be removed for servicing of the wheel and/or brake.

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 thereafter 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 contaminates 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 Lancair tires should be properly inflated at all times. The nose wheel tire should contain 28 to 30 psig and the main gear tires from 40 - 45 psig. 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 >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

Your aircraft is fitted with rubber biscuit type shock absorbers on the main gear. These require no servicing or inflation. As long as they are not physically cut or damaged and remain free of excessive checking due to age they remain serviceable.

Nose wheel struts (320/360 style) contain air (nitrogen) and oil and is a sealed system. It 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.

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 cowling 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 Neico 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 minimize 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 235/320/360
ANNUAL TYPE CONDITION INSPECTION

Model:______________ Serial Number____________ Registration Number____________

Tachometer Time ___________ Total Time ___________ Date ____________

	Mech Initial	Discrepancy
ENGINE "GROUP A"		
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 @ 1200RPM until oil temperature reaches 140°F.		
5. Idle oil pressure psi		
6. Magneto check: DROP L/H . R/H @ 1800 RPM		
7. Cycle prop and 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 and vibrations.		
12. Check idle speed and mixture rise @ RPM.		
13. Magneto ground check		
14. Compression check: #1 /80. #2 /80. #3 /80. #4 /80		
ENGINE "GROUP B"		
1. Drain engine oil.		
2. Remove oil filter and or screen. and check for contaminates.		
3. Drain engine breather can if installed. Check whistle or slit for obstructions.		
4. Install new oil filter or replace screen gasket. Service engine with recommended quantity of oil.		
5. Clean and gap spark plugs. Rotate plugs top to bottom.		
6. Check ignition harness for chaffing and general condition.		
7. Check condition of magneto points. set or replace as necessary.		
8. Check magneto to engine timing in accordance with engine data plate.		
9. Check exhaust system for cracks. security. and condition of gaskets.		
10. Check intake pipes for condition and leaks.		
11. Check condition of air box. clean or replace air filter element as necessary.		
12. Check condition of alternate air system and flapper valves.		
13. Check engine baffles and cowling for general condition.		
14. Inspect fuel hoses for general condition.		
15. Inspect oil cooler and hoses for general condition.		
16. Clean injector nozzles.		

	Mech Initial	Discrepancy
...eplace or clean fuel filter and screens as necessary.		
... Check engine vibration isolators for poor condition and deterioration.		
18. Check engine mount for cracks and security to firewall.		
19. Check engine for oil leaks.		
20. Check prop. gov. for leaks and security. and condition of cable end.		
21. Check starter for security and condition.		
22. Check alternator and mount for security, condition of wiring and belt for condition and tension.		
23. Check vacuum pump for security and condition.		
24. .Check tach cable or wiring for security and condition.		
25. Wash engine. CAUTION: DO NOT CONTAMINATE VACUUM PUMP or INDUCTION SYSTEM WITH FLUID		
26. Lubricate engine controls and check for connections and travel.		
PROPELLER "GROUP C"		
1. Inspect propeller for cracks. nicks. binds and oil or grease leaks.		
2. Remove minor nicks and dress blades as necessary.		
3. Check propeller mounting bolts for torque and safety wiring.		
4. Check blades for looseness in hub.		
5. Inspect spinner. screws and bulkhead for cracks and condition.		
...ubricate propeller per manufacturer's recommendation.		
CABIN "GROUP D"		
1. Check seat belts for general condition and defects.		
2. Check battery for electrolyte level and S.G and charge.		
3. Check battery vent for security and obstructions.		
4. Clean battery cable terminals if required and reinstall battery.		
5. Check hydraulic power pack and lines for leaks. security. and fluid level.		
6. Check elevator idler arm and bob weight for security and lubricate rod ends		
7. Inspect. flap motor compartment. rods and motor for proper operation. running current and lubricate		
8. Check aileron. elevator push tubes and trim systems and lubricate rod ends		
9. Check for loose equipment that might fowl the controls.		
10. Inspect rudder cables. and attachments etc		
11. Inspect brake master cylinders and parking brake valve for leakage. free and full extension and proper operation. Check fluid level at the master cylinders.		
12. Check condition of instrument panel. wires. hoses. and vacuum filters		
13. Check compass for fluid level and correction card.		
14. Check instrument lights		
... Check instruments for proper markings. general condition and security		
... lean inside of cabin and insure that drain holes are clear		
17. Inspect fuel lines and tank for security and leaks.		
18. Inspect pitot static lines		

Rev. 4, July 1994

	Mech Initial	Discrepancy
WING "GROUP H"		
1. Remove inspection covers.		
2. Inspect and lubricate all bell cranks, push rods, and end rods.		
3. Check all wing attach bolts for security and condition.		
4. Check flaps for general condition, and operation.		
5. Check flap actuating rods, bell cranks, hinges, and bearings for condition, and lubricate		
6 Check pitot mast and lines for security and obstructions		
7. Check ailerons for condition and hinges for wear, lubricate.		
8. Install inspection covers.		
ELECTRICAL "GROUP I"		
1. Check navigation lights.		
2. Check landing and taxi lights.		
3. Check strobes for proper operation and security.		
4. Check cockpit and instrument lights.		
5. Check pitot heat.		
6. Check ELT for operation and battery due date.		
RADIO "GROUP J"		
1. Check radio and electronic equip. for proper installation and secure mounting.		
2. Check wiring and conduits for proper mounting and obvious defects.		
3 Check bonding and shielding for improper installation and condition.		
4. Check antennas for condition, secure mounting and proper operation.		
GENERAL "GROUP K"		
1. Check all optional equipment for security and proper operation.		
2. Check all placards.		
3 Check canopy and hardware for general condition, operation and lubricate.		
4. Check composites for signs of delaminations, distortion, cracks, damage and lost paint or other evidence of failure..		
5 Clean interior and wash exterior.		
6. Run up engine and check oil pressure and all gauges for proper operation.		
7. Magneto check at 1800 RPM L ______ RPM drop, R ______ RPM drop		
8. Check operation of prop. governor		
9 Check max. M.P. and T.O. RPM		
10. Check idle speed and mixture.		
11. All paper work properly signed and AD's and SB's complience checked.		
12. Inspect each installed miscellaneous item that is not otherwise covered by this listing for proper operation and installation. See FAR Part 43 Appendix D.		
13 Periodically use the dump valve to extend the gear in flight checking for full down and locked condition		

Rev. 4, July 1994

	Mech Initial	Discrepancy
FUEL SYSTEM "GROUP E"		
1. Check fuel transfer pumps for operation.		
2. Check fuel tank filters and sump drains for contaminants.		
3. Check all fuel vents for security and obstructions.		
4. Check fuel lines for security, chaffing, and leakage.		
5. Check fuel tanks and caps for leakage, security and placards.		
6. Check fuel boost pump for operation, leaks and security.		
7. Check fuel shut-off valve for operation and leakage.		
LANDING GEAR "GROUP F"		
1. Place aircraft on jacks.		
2. Clean excess grease off gear legs, struts, and wheels.		
3. Check brake discs and linings for wear or cracks.		
4. Check wheels for general condition and cracks.		
5. Check tires for wear, condition, and proper inflation.		
6. Check wheel bearings for corrosion and wear, re-pack with grease.		
7. Check main gear trailing beams and bolts for wear.		
8. Check main gear weldment for fore and aft end play.		
9. Check compression assemblies and 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# minimum to compress.		
12. Retract the gear checking for wear and freedom of movement of all bearings of gear and drag strut assembly. Lubricate all moving points. Check pressure within limits.		
13. Check gear doors for fit and security. Lubricate pivot points and rods.		
14. Free fall the gear using the dump valve. Check for freedom of movement and over centering of links. Check gear using power pack and check pressure down within limits.		
15. Check nose oleo shimmy damper for proper resistance to movement.		
16. Check nose gear oleo for condition and 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 and tire or tang do not hang up when gear is retracted.		
18. Check operation of gear position lights and switches.		
19. Check all gear actuators and sequence valves for proper operation and leakage.		
20. Check gear switch is down and dump valve closed. Remove aircraft from jacks.		
EMPENAGE "GROUP G"		
1. Remove exterior inspection covers. Inspect for security and wear and lubricate torque tubes, cables and bell cranks. Reinstall inspection covers.		
2. Inspect rudder hinges and rudder attachment pin and safetied.		
3. Inspect trim tabs, elevator hinges, and lubricate.		

NOTES:

NOTES:

NOTES:

Supplements

Section IX

Table of contents

Intentionally Left Blank

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 compliment to your Lancair.

Per the GAMA Specification, "This section of the POH shall contain he 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 Lancair 235, 320/360. 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 or 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 in the format of this handbook.

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 certificating 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.

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

Supplement

for the

(System or equipment)

General - *(Description & purpose of equipment)*

Limitations - *(Of equipment)*

Approved by

Date

Emergency Procedures

Emergency Procedures *(Continued)..........*

Normal Procedures

Normal Procedures *(Continued)..........*

Performance

System Description

Servicing and Mainenance

Approved by____________________

Date ____________________

NOTES:

Safety Information

Section X

Table of contents

Intentionally Left Blank

INTRODUCTION

Your Lancair 235-320/360 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 235, 320, or 360 pilot.

If you built the aircraft you are undoubtedly familiar with the aircraft and its systems and much 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 235/320/360 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 operation 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 takeoff 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, navaids 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 Spacial 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 mor 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 Lancair 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 Lancair 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 Lancair <u>with ice</u> 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-out

6. Black-out

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 800 feet AGL, just land on the remaining runway or within ± 30° 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 re-started. 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 (Vne) 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 other than header tank fuel.

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 a 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