PILOT'S OPERATING HANDBOOK

AND
AIRPLANE FLIGHT MANUAL

Manufacturer'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.

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

This Handbook meets GAMA Specification No. 1, Specification For Pilot's Operating Handbook, issued February 15, 1975 and revised October 18, 1996.

Published by

Lancair International Inc.
250 SE Timber Ave.
Redmond, Oregon 97756

PILOT'S OPERATING HANDBOOK

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March 2014

LOG OF REVISIONS

PAGES	DESCRIPTION
December 2010	
All	Re-issue. Revised tables of contents. Revised Sections II, IV, and VI.
Febrtary 2011	
II-3	Indicated V_{NE} is in KCAS.
II-11	Revised CG Limits.
II-12	Revised the Weight and CG Envelope chart.
III-6	Changed “Fen” to “Gen”.
V-3 and V-4	Revised the CG range in the Warning. Deleted the Note about battery placement. Repaginated page V-4.
V-5	Revised the CG range in the Note.
March 2012	
All	Reissued in its entirety.
June 2012	

IV-3	Changed the rotate speed from “65-70” to “65-80”
IV-6 thru IV-9	Added wheel chock removal to the Before Engine Start checklist and removed it from the Taxi checklist. Changed the Propeller Control Lever procedure from “Before Proceeding to Ground Run” to “(First Flight of the Day)”. Changed “Moritz Control” to “Systems Controller” in the Taxi checklist. Changed “Up, Before 120 KIAS” to “Up (120 KIAS)” in the Takeoff checklist. Added “Trim” procedure to the Before Landing checklist.
V-4 thru V-6	Revised the weight and balance calculation instructions.
VI-4	Revised the control stick figure.
VI-10 thru VI-12	Indicated a control strap is available through Lancair to the Control Locks paragraph.
VI-33 thru VI-36	Deleted Takeoff and Climb, and Cruise and Descent paragraphs. Removed pages VI-35 and VI-36.
VII-9 thru VII-11	Revised step 5 of the hydraulic system servicing section.
VII-18 thru VII-20	Revised the 50 and 100 hours checklists.
VIII-3, VIII-5, and VIII-6	Replaced the Weight and Balance Worksheet and the Example.
July 2012	
VII-10	Changed “305” to “250” for main gear strut pressure.

May 2013	
I-13	Deleted the definition of Accelerate-Go Distance because it does not apply to single engine aircraft.
II-9 and II-10	Revised the CG limits and the Weight and CG Range figure.
III-10 and III-11	Revised “Moritz” to “Radiant (Moritz)”. Revised the Low Fuel Pressure and the Low Oil Pressure (<75 psi) procedures.
IV-7 thru IV-9, IV-12 and IV-13	Revised the Engine Start procedure. Added overspeed governor test to the Before Takeoff procedure. Revised “Moritz” to “Radiant (Moritz)”. Added a fuel selector step and a caution to the Post Flight procedure.
V-6	Changed “5.6” to “6.8”.
VI-1	Revised the Table of Contents.
VI-9 thru VI-36	Added description of the gear warning system. Moved the fuel system description to the next page. Added a caution note. Revised “Moritz” to “Radiant (Moritz)”.
VII-1	Revised the Table of Contents.
VIII-7 thru VIII-22	Added the Recommended Minimum Equipment List. Added Performance Charts defining recommended settings for maximum engine life.
March 2014	
I-8	Revised the Airplane 3-View.
II-3	Changed “25°” to “24°” “50°” to “48°”.

III-8	Changed “25°” to “24°”.
IV-3	Changed “25 deg.” To “24 deg.”
IV-8 thru IV-11	Revised the Taxi, Before Takeoff, Before Landing, Go Around/Balked Landing, and Touch and Go Landing checklists.
V-1 and V-3 thru V-8	Revised the Table of Contents and added a Useful Load Arms section.
VI-6	Changed flaps positions to 24° (half) and 40° (full down).

INTRODUCTION

This Lancair International Inc., Pilot's Operating Handbook and Airplane Flight Manual contains data recommended in the GAMA (General Aviation Manufacturers Association) Handbook Specification Number 1.

WARNINGS, CAUTIONS AND NOTES

The following definitions apply to warnings, cautions and notes in the flight manual.

WARNING

A Warning means that disregarding the subject procedure may lead to an immediate or important degradation of flight safety.

CAUTION

A Caution means that the non- observation of the subject procedure may lead to a possible degradation of flight safety.

NOTE

A Note draws attention to any special item which may or may not be directly related to flight safety, but which is important or possibly unusual.

LANCAIR PARTS

Lancair parts are produced and inspected to ensure airworthiness commensurate with use in the aircraft. Non-Lancair approved parts, while appearing suitable, may not have been fabricated under adequately controlled conditions and may be unsuitable and/or dangerous when used in your airplane.

NOTE

Modifications to the airplane 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 Lancair when repairing your airplane.

NOTE

The use of salvaged airplane parts and reworked parts, from other sources with unknown service history is considered dangerous. Often these parts may have been subjected to excessive stress levels, temperatures, or have hidden damage not discernible through normal inspection techniques and thereby must be considered unacceptable for use.

Lancair International Inc. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by the use of non-Lancair approved parts.

HANDBOOK TABLE OF CONTENTS

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General

Section I
Table of Contents

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THANK YOU.....

You have obtained the latest state-of-the-art in a high performance general aviation aircraft. Its performance is spectacular and its life almost unlimited 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 Federal Aviation Regulations (FAR) that are applicable to your operation. The operator should also be familiar with the Federal Aviation Regulations as applicable to the operation and maintenance of experimental airplane and FAR Part 91 General Operating and Flight Rules. The aircraft must 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 combination will provide you the knowledge for operation of your personally manufactured Lancair.

IMPORTANT NOTICE

This handbook must be read carefully by the owner or operator(s) of your Lancair Evolution aircraft in order to become familiar with its operation. Hereinare suggestions and recommendations to help you obtain safe performance without sacrificing economy. You are encouraged to operate your aircraft in accordance with the limits identified in this Pilot's Operating Handbook as well as any placards located in the airplane.

The FAR's place the responsibility for the maintenance of this airplane on the owner and the operator. Maintenance may be accomplished by the owner or qualified mechanics in conformity with all airworthiness requirements and Lancair recommendations established for this airplane.

Lancair may from time to time provide additional or revised service, repair, or operating procedures issued by both the FAA and/or Lancair International to obtain the maximum prudent usefulness and safety from your aircraft.

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 Lancair Evolution.

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

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, some optional equipment has been included in the scope of this handbook. 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 will automatically be provided to the holder of this manual:

1. Original issues and revisions of Service Bulletins
2. Original issues and revisions of Lancair Approved Airplane Flight Manual Supplements
3. Revisions of the Airplane Flight Manuals, Flight Handbooks, Owner's Manuals, Pilot's Operating Manuals and Pilot's Operating Handbooks

This service is available to holders of this handbook who are listed on the Lancair Owner/Builder List. All aircraft must be registered by serial number for the model for which this handbook is applicable. Detailed information on this "Revision Service" can be obtained from Lancair customer support.

NOTICE

LANCAIR INTERNATIONAL INCORPORATED EXPRESSLY RESERVES THE RIGHT TO RECALL, 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 STC's (Supplemental Type Certificate) or Lancair Supplements for appropriate placards, limitations, normal, emergency and other operational procedures for proper operation of their Lancair, including optional equipment installed.

REVISING THIS HANDBOOK

WARNING

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

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.

DESCRIPTIVE DATA

ENGINE

The Lancair Evolution may have the following engines installed:

Pratt & Whitney PT6A-135A
Pratt & Whitney PT6A-28
Pratt & Whitney PT6A-21

Although other engines are available, the PT6A-135A will give optimum performance.

PROPELLER

The Lancair Evolution is designed to use either the Hartzell, HC-E4N-3NX/D8292BX*2, 4 bladed constant speed propeller or the MT-Propeller, MTV-27-1-E-C-R(P)CFR206-58, 5 bladed constant speed propeller.

NOTE:

Contact Lancair International Inc. for other approved propellers other than those indicated above.

FUEL

For approved fuel and additives refer to the latest revision of Pratt and Whitney Service Bulletin P&WC S.B. No. 1244.

STANDARD SYSTEMS CAPACITY

Standard fuel capacity 168 US Gal.

NOTE

Usable fuel must be determined for each aircraft by the builder/owner.

OIL CAPACITY

2.3 US gallons

WEIGHT (lbs.):

Max ramp weight	4314
Max gross takeoff	4300
Max landing weight	4200
Max weight in baggage compartment*	225

* If inside CG envelope in weight and balance.

CABIN DIMENSIONS (Inches)

Length	126
Height (maximum)	48
Width (sidewall)	
Front Seat	46
Rear Seat	43

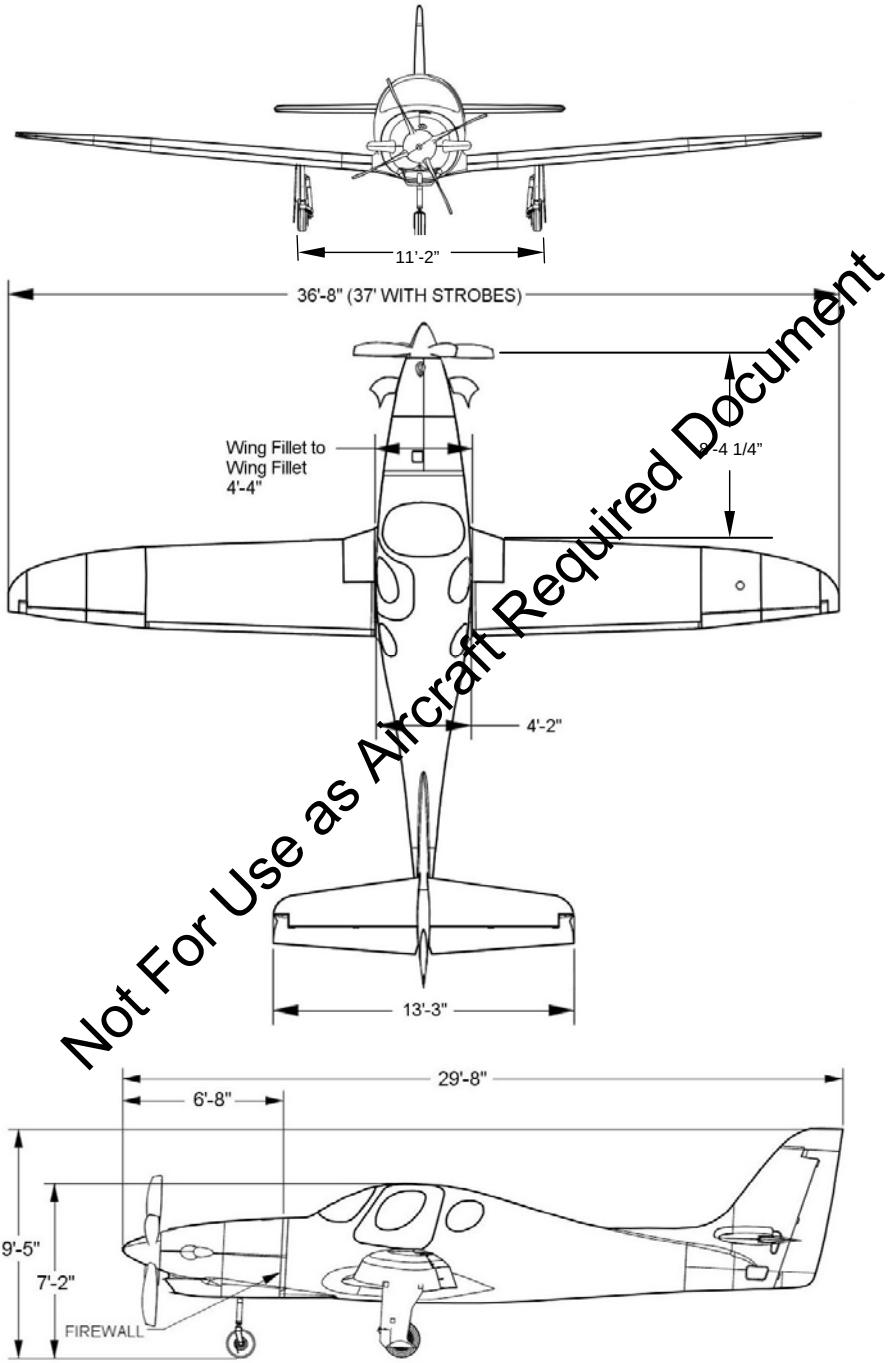
BAGGAGE

Compartment Volume	Approx. 39 Cu. Ft.

SPECIFIC LOADING (maximum takeoff weight):

Wing loading	32.3 lb/sq. ft.
Power loading (750 shp)	5.73 lb/shp
Wing area	133 sq. ft.

AIRPLANE 3-VIEW



TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

CAS *Calibrated Airspeed* means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.

KCAS *Calibrated Airspeed* expressed in "knots".

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 when corrected for instrument error. IAS values published in this handbook assume zero instrument error.

KIAS *Indicated Airspeed* expressed in "knots".

M *Mach number* is the ratio of true airspeed to the speed of sound.

TAS *True Airspeed* is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.

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_{MCA} *Air Minimum Control Speed* is the minimum flight speed at which the airplane is directionally and laterally controllable, determined in accordance with the Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling (or, in airplanes with autofeathering devices, feathered), not more than a 5" bank toward the operative engine, takeoff power on the operative engine, landing gear up, flaps in the takeoff position, and the most critical C.G.

V_{MO} *Maximum Operating Limit Speed* is the speed limit that may not be deliberately exceeded in normal flight operations. V is expressed in knots.

V_{NE} *Never Exceed Speed* is the speed limit that may not be exceeded at any time.

V_{NO}/V_C *Maximum Structural Cruising Speed* is the speed that should not be exceeded except in smooth air and then only with caution.

V_S *Stalling Speed* or the minimum steady flight speed at which the airplane is controllable.

V_{SO} *Stalling Speed* or the minimum steady flight speed at which the airplane is controllable in the landing configuration.

V_X *Best Angle-of-Climb Speed* is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

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

METEOROLOGICAL TERMINOLOGY

ISA *International Standard Atmosphere* in which

1) The air is a dry perfect gas;
2) The temperature at sea level is 15° Celsius (59° Fahrenheit);
3) The pressure at sea level is 29.92 in. Hg. (1013.2 millibars);
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* is the free air static temperature, obtained either from in-flight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.

Indicated Pressure Altitude The number actually read from an altimeter when the barometric subscale has been set to 29.92 in Hg or 1013.2 millibars.

Pressure Altitude Altitude measured from standard sea-level pressure (29.92 in Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero. Position errors may be obtained from the Altimeter Correction Graph.

Density Altitude The altitude at which the density of the International Standard Atmosphere (ISA) is the same as the density of the air being evaluated.

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 Power (MCP) The highest power rating not limited by time.

Cruise Climb Power The power recommended for cruise climb.

ENGINE CONTROLS/INSTRUMENTS

Power Control Lever (PCL) The *Power Control Lever* is used for controlling the compressor speed (Ng) and the propeller pitch in reverse. (Beta) In the forward operation mode, the power lever controls Ng speed only and has no effect on the beta valve.

From idle to full reverse position, the power lever increases Ng and also moves the beta valve to change propeller blade angle into reverse pitch. The range of operation is referred to as BETA MODE. Taxiing the aircraft is accomplished in this mode.

Compressor turbine speed can be read on the engine Ng gauge in %.

The primary power instrument is the Torquemeter Gauge and is read in ft/lbs.

Propeller Control Lever The *Propeller Control Lever* is connected to the speed lever on top of the propeller governor (CSU) and is used for two purposes:

(1) Control the propeller speed in the governor mode (cruise)
(2) Allows the pilot to feather the propeller on the ground prior to shutdown or during flight, in the event of an in-flight shutdown.

The propeller speed is read on the engine Np gauge in RPM.

Fuel Condition Lever (FCL) The *Fuel Condition Lever* (FCL) controls the fuel flow to the engine. When starting, the FCL is moved to the LOW idle position when the correct Ng is reached.

The Shut-off position stops the fuel flow to the combustion chamber and causes engine shut down.

From LOW to HIGH idle, the fuel lever rotates the fuel control unit input lever to increase Ng to a specified value. This value is the minimum compressor speed allowed for flight operations.

ITT Provides the pilot with an indication of the engine combustion temperature. This temperature is sampled between the compressor turbine exit and the power turbine vane inlet. The temperature is read in degrees Centigrade on the ITT gauge.

PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Climb Gradient The demonstrated 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 D*emonstrated 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.

Accelerate-Stop Distance The distance required to accelerate an airplane to a specified speed and assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.

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 (CG) 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.

Unusable Fuel Fuel remaining after all usable fuel has been exhausted.

Standard Empty Weight Weight of an empty airplane including unusable fuel, full operating fluids, and full engine oil.

Basic Empty Weight Standard empty weight plus any optional equipment.

Payload Weight of occupants, cargo and baggage after full fuel is added.

Useful Load Weight of all occupants, baggage and fuel or the difference between take-off weight or ramp weight if applicable and basic empty weight.

Maximum Ramp Weight Maximum aircraft weight approved for ground maneuvering. (It includes weight of start, taxi and run-up fuel (typically 2 gallons)).

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

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

Zero Fuel Weight Weight exclusive of usable fuel.

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

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

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Limitations

Section II
Table of Contents

GENERAL

The limitations presented herein are those established by Lancair International Inc. as applicable to the Lancair Evolution model aircraft. Unless otherwise indicated, the airspeeds quoted are given in indicated airspeeds (KIAS) and assumes zero instrument error.

NOTE

It is imperative that your pitot and static system has been properly calibrated and account for any noted errors.

AIRCRAFT OPERATING SPEEDS

SPEED	MARKING	KIAS
Never exceed speed	V_{NE} Red Line	256 (KCAS)
Maximum Mach number	M_{MO}	M .621
Caution, smooth air only	V_C Yellow Arc	220-256
Maneuvering Speed	V_A	190
Normal Operating range	V_{NO} Green Arc	76-220
Best glide speed for range	L/D Max	110
Flap Operating range	V_{FE} White Arc	61-140
Approach: 24° Extension		160
Landing: 26° to 38° Extension		140
Landing Gear Operating speed	V_{LO}	150
Landing Gear Extended Speed	V_{LE}	165
Best Angle of climb speed	V_X	85
Best Rate of climb speed	V_Y	105
Cruise climb		140
Stall Speed, clean*	V_S	76
Stall Speed landing config.*	V_{SO}	61
*Verify with flight testing.		
Max. Structural Cruise speed (SL to FL240)		190

Pattern speed	
Downwind	100
Base	90
Final	80
Max. demonstrated cross wind	20 Kts

NOTE

- **V_{NE} must be reduced by 4 knots for each 1000 feet above 24,000 feet pressure altitude.**

- **Maximum structural cruise speed must be reduced by 4 knots for each 1000 feet above 24,000 feet pressure altitude.**

- **Add 10 KIAS to the pattern speeds for a no-flap pattern**

POWERPLANT LIMITATIONS

The Lancair Evolution is typically powered with the Pratt & Whitney PT6A-135A, 927 Thermodynamic h.p., engine. Operating limitations for the PT6A-135A engine are listed below. If your engine differs, you must account for that. In addition, the data and limits shown are for new specification engines and do not reflect any degradation due to age or number and quality of overhauls.

Power Setting	SHP	Max. Torque		Max. Observed ITT °C	Ng (100%= 37500 rpm)		Np (100%= 1900 rpm)		Oil Press. PSIG (2)	Oil Temp. °C (8)
		Lb. ft.	psi		RPM	%	RPM	%		
Takeoff and Max. Cont.) Enroute) Emergency	750 33.9°C (93°F)	2080	59.1	805	38100	101.6	1900	100	85 to 105	10 to 99 (50° to 210°F)
Max. Climb	700 40.6°C (105°F)	1940	55.1	805	38100	101.6	1900	100	85 to 105	0 to 99 (32° to 210°F)
Max. Cruise	700 40.6°C (105°F)	1940	55.1	805	38100	101.6	1900	100	85 to 105	0 to 99 (32° to 210°F)
Idle				685 (5)	19500 (Min.)	52 Typ.			40 (Min.)	-40 to 99 (-40 to 210°F)
Starting				1090 (4)(7)						-40 (Min.)
Transient	955	2400 (11)	68.2 (11)	880 (4)	38500 (4)	102.6 (4)	2090 (10)	110 (10)	85 to 105	0 to 99 (32° to 210°F) (9)
Max. Reverse	720	2080	59.1	805	38100	101.6	1825	96 (±1%)	85 to 105	0 to 99 (32° to 210°F)

GENERAL NOTE: The operating parameters in this table are individual limits for each engine parameter and do not apply simultaneously.

NOTE: 1. All limits are based on sea level and ambient temperatures as specified.

NOTE: 2. Minimum oil pressure above 27,000 Ng is 85 psig.

NOTE: 3. For overtemperature and overtorque action, refer to Figures 501, 502, and 504, and to Chapter 72-00-00, Table 604 of the latest revision of Pratt & Whitney Canada, Maintenance Manual, Manual Part No. 3043512.

NOTE: 4. These values are time limited to two (2) seconds.

NOTE: 5. Increase Ng to keep within this limit.

NOTE: 6. If maximum torque is used, Np must be set so as not to exceed power limitations. Reverse power operation is limited to one (1) minute.

NOTE: 7. Starting temperatures above 880°C (1616 °F) should be investigated for cause.

NOTE: 8. For increased oil service life, an oil temperature of below 80°C (176°F) is recommended.

NOTE: 9. Maximum permissible transient oil temperature is 104°C (210°F) for ten (10) minutes.

NOTE: 10. In the event of failure of the propeller governor toward overspeed, it is permissible to complete a flight with propeller control via the overspeed governor (on engines so equipped) providing this limit is not exceeded.

NOTE: 11. These values are time limited to twenty (20) seconds.

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FUEL

Refer to the latest revision of Pratt & Whitney Service Bulletin No. 1244 for approved fuels and additives.

OIL SPECIFICATION

Refer to the latest revision of Pratt & Whitney Service Bulletin No. 1001 for approved oils.

ALTITUDE LIMITATIONS (RVSM LIMITED)

The service ceiling of the aircraft is 28,000 feet.

The shoulder altitude where compressibility effects become important is 24,000 feet. Above this altitude, equivalent airspeeds must be reduced to maintain a constant Mach number.

M_C = 0.461 for cruise speed at 24,000 feet.
M_{NE} = 0.621 for never exceed speed at 24,000 feet.

POWERPLANT INSTRUMENT MARKINGS

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

NOTE

Pratt & Whitney values shown. The owner/operator should compare and correct (where different) for the particular model specifications for his installation.

OIL TEMPERATURE (Deg. C.)

Normal Operating range (Green arc)	-40 to 99
Maximum (Red line)	100
Recommended Takeoff Minimum	0 to 99

OIL PRESSURE (PSI)

Minimum (Idle, Red line)	40
Operating Range (Green arc)	85 to 105
Maximum (Red Line)	105

Np (RPM)	**PT6A-135A**	*_____
Operating Range (Green Arc)	900 to 1900	*_____
Maximum (Red Line)	2090	*_____

ITT (Deg. C)	**PT6A-135A**	*_____
Max. Continuous (Green Arc)	805	*_____
Peak 2 Second limit (Red Line)	880	*_____

* Fill in these blanks for engines other than the Pratt & Whitney PT6A-135A.

MISC. INSTRUMENT MARKINGS

HYDRAULIC PRESSURE (psi)

Normal System Operating Pressure	2000
Accumulator pre-charge	1000 to 1100

WEIGHT LIMITS (lbs)

Maximum Empty Weight	3204
Maximum Takeoff Weight	4300
Maximum Landing Weight	4200
Maximum Baggage Weight	225

PROPELLER

Number of Propellers: 1
Propeller Manufacturer: Hartzell Propeller, Inc. or MT-Propeller
Propeller Number: HC-E4N-3NX/D8292BX*2, or MTV-27-1-E-C-R(P)CFR200-58d, respectively

WARNING

Stabilized ground operation within the propeller restricted RPM range (400 to 1200 RPM Np) can generate high propeller stresses and result in failure and loss of control of the aircraft.

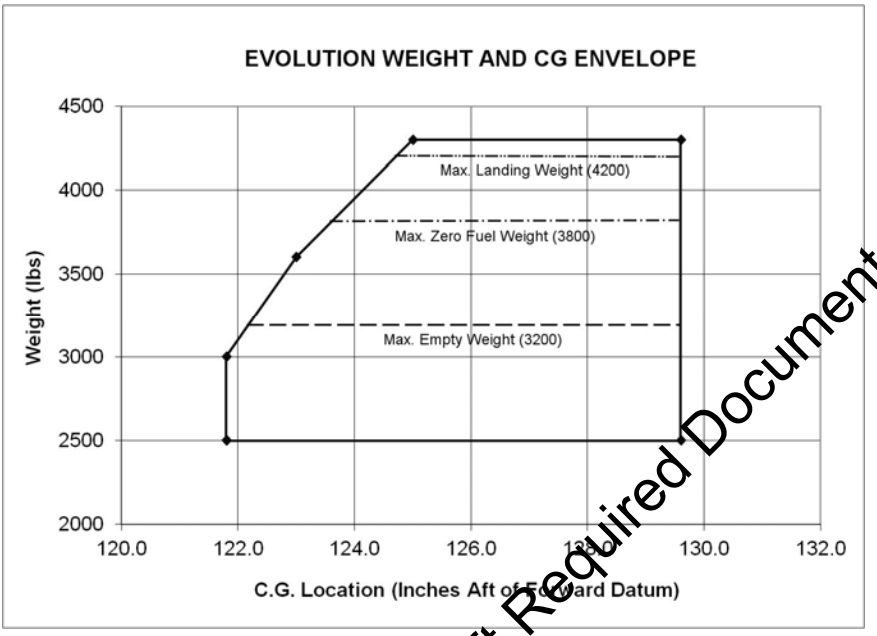
CENTER OF GRAVITY LIMITS (Gear Extended)

The allowable Center of Gravity (CG) range is from Fuselage Station (FS) 121.9 to FS 129.6 or 10.0% to 28% of the wing mean-aerodynamic-chord (MAC).

REFERENCE DATUM

The Datum is located at FS “0.” This can be located by measuring 78” forward of the firewall.

WEIGHT AND CG RANGE



FLIGHT LOAD FACTOR LIMITS

Flaps up (Approach)	+4.4 G's to -2.2 G's
Flaps down (Landing)	+2 .2G to 0

TYPES OF OPERATIONS AND LIMITS

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

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

WARNING

- **Flight operations with passengers for hire is prohibited.**
- **Flight into known icing is prohibited.**

SPINS

WARNING

Spins are prohibited

If a spin is inadvertently entered, the stick should be neutralized or placed slightly forward of neutral and the rudder positioned full travel against the direction of the spin until rotation is stopped. At this point, neutralize the rudders and recover from the ensuing dive with a smooth, positive pullout of no more than 4 G's, taking care not to enter an accelerated stall or re-enter another spin. Because of the clean aerodynamics of the Evolution, excessive altitude might be lost in the dive recovery.

FUEL QUANTITIES (U.S. Gal.)

Standard fuel 168

FUEL MANAGEMENT – MAXIMUM FUEL DIFFERENCE BETWEEN EACH TANK

Do not take off with less than 10 gallons in each tank. There is no interconnection between the wing tanks. Allow no more than 10 gallons differential between the left and right tank for safe operation.

WARNING

Limit excessive angles of attack (pitch up) during go around with less than 10 gallons in either tank.

SEATING

The aircraft accommodates 4 adult occupants. Fully functional controls allow the aircraft to be flown from either front seat.

WINTER OPERATIONS

Winter Operations are acceptable with proper oil grades for the operating temperatures. Engine pre-heating is recommended when the ambient temperature is below freezing.

WARNING

Takeoff is prohibited when there is any evidence of frost/ice or snow on the wings, horizontal tail, or flight controls.

LANDING GEAR

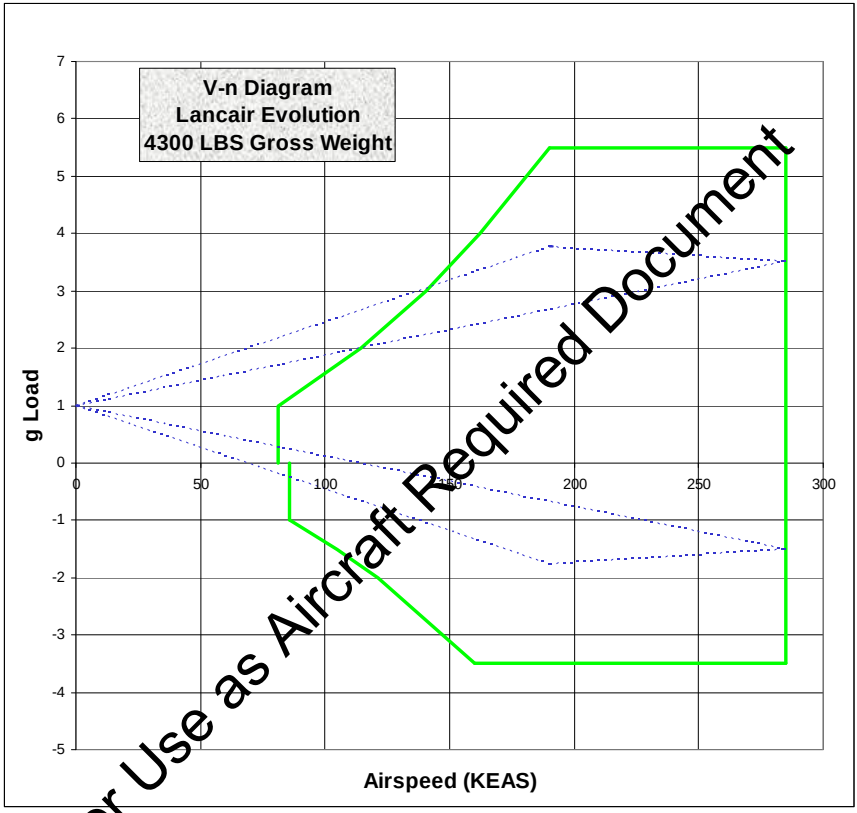
Nose gear rotation is limited to 50° either side of center

CAUTION

Avoid pivoting on one main gear while taxiing to avoid undue stress. Attempt to limit inboard main gear turn radius to 25 feet to minimize tire wear and stress on the main landing gear links.

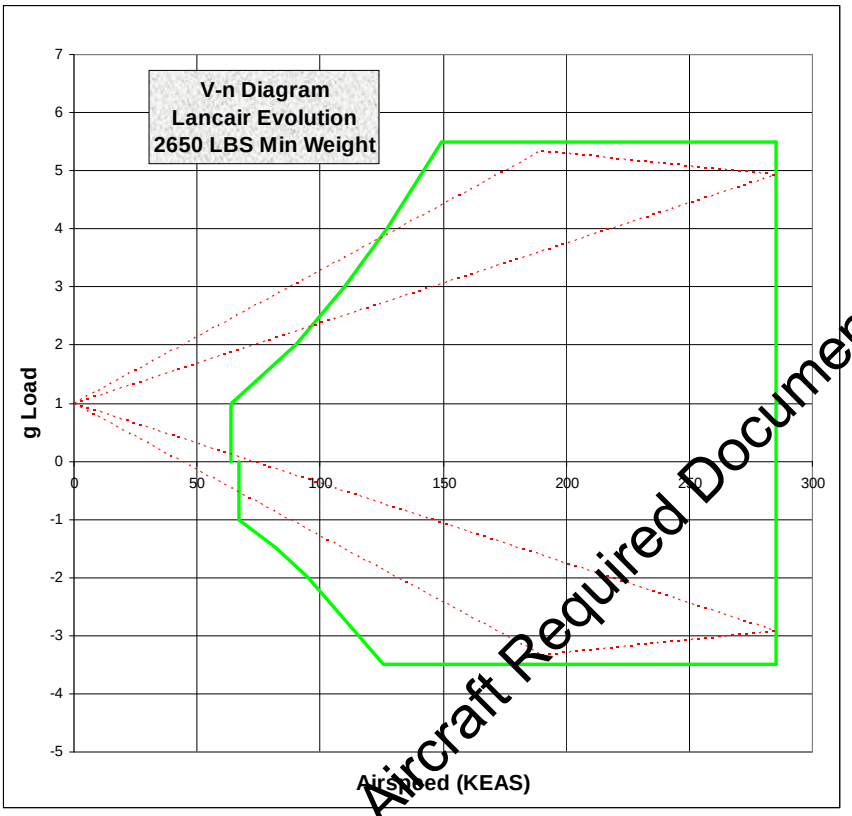
MANEUVER AND MAXIMUM GUST LOAD FACTORS

The maneuver and maximum gust load factors and corresponding equivalent airspeeds.



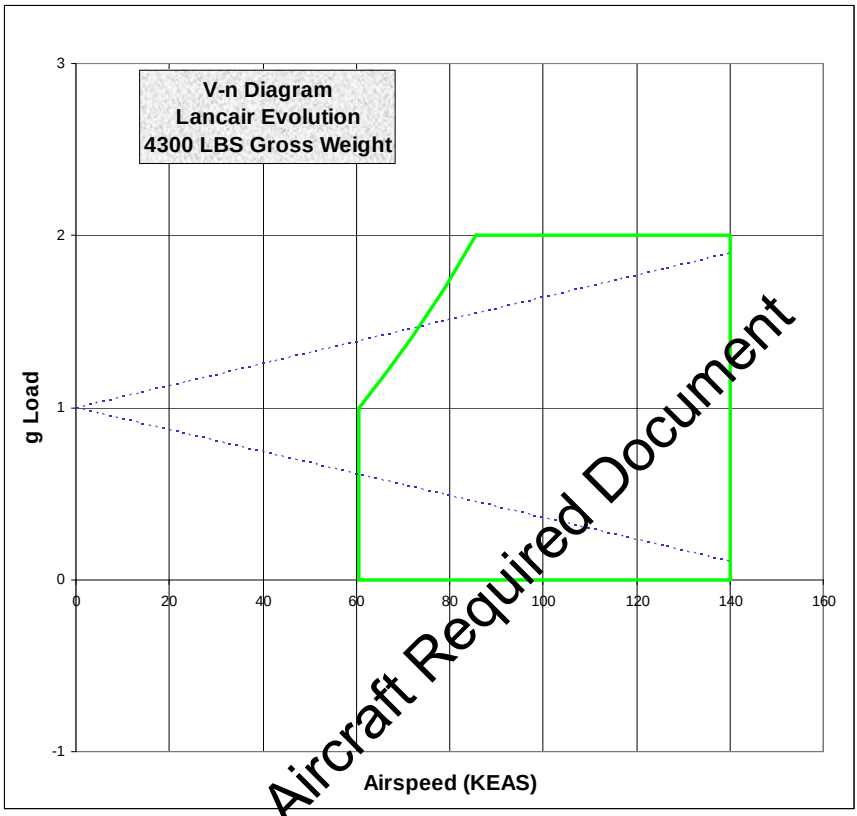
V-n Diagram at Gross Weight.

Gust Factors for 24,000 Ft Altitude



V-n Diagram at Minimum Weight.

Gust Factors for 24,000 Ft. Altitude



V-n Diagram Landing Flap Configuration at Gross Weight.

Gust Factors for 12,000 Ft. Altitude

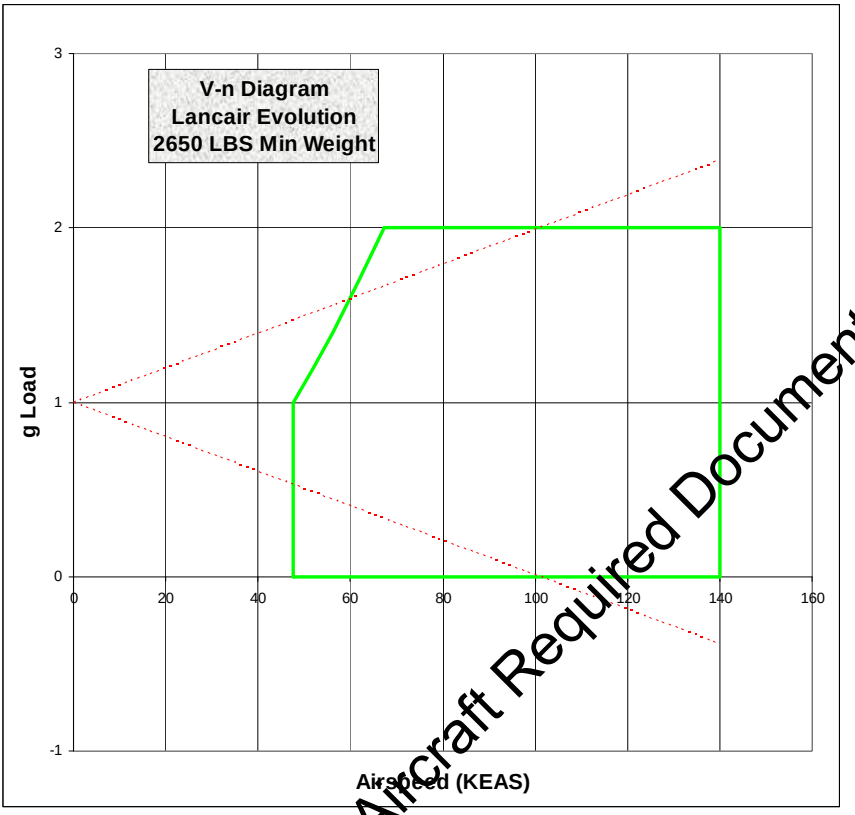
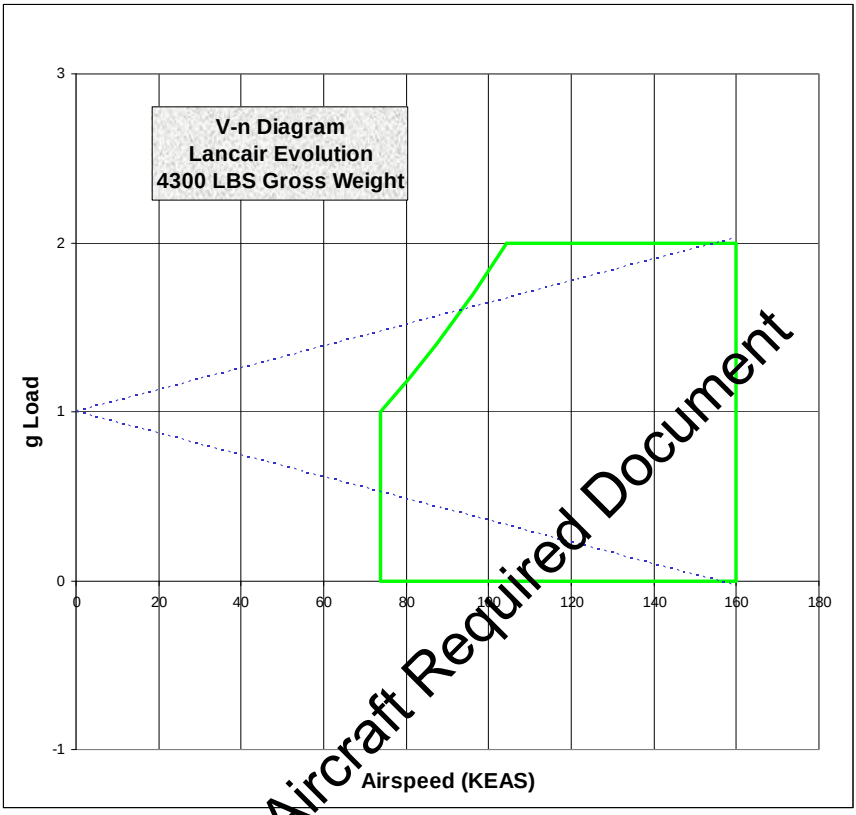
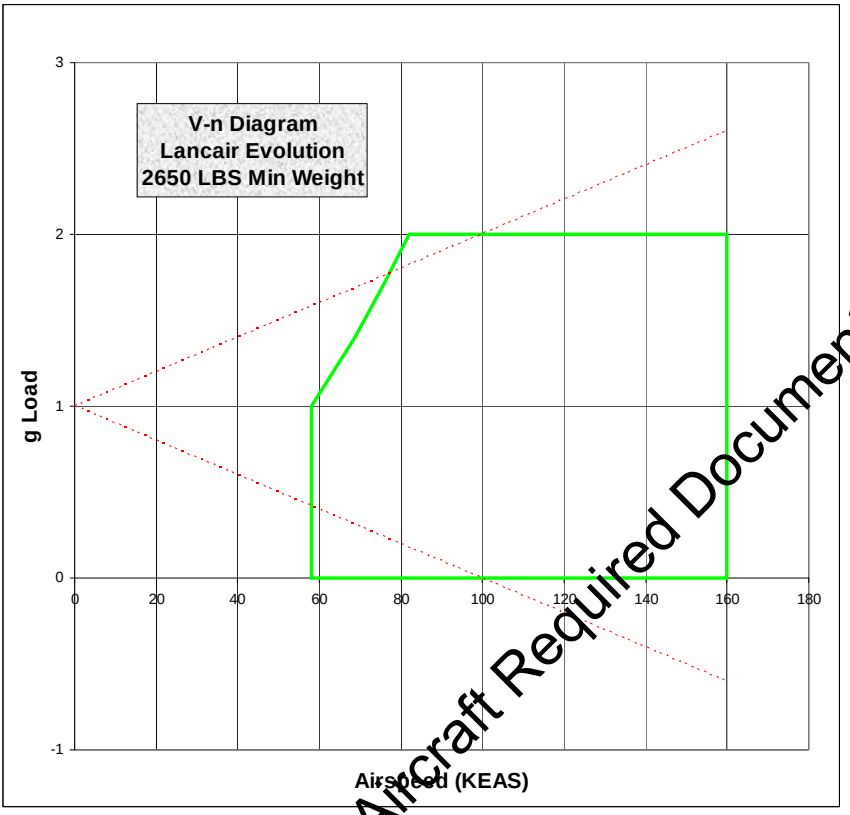


Figure 6. V-n Diagram Landing Flap Configuration at Minimum Weight.

Gust Factors for 12,000 Ft. Altitude



V-n Diagram, TO Flap Configuration at Gross Weight.
Gust Factors for 12,000 Ft. Altitude



V-n Diagram TO Flap Configuration at Minimum Weight.

Gust Factors for 12,000 Ft. Altitude

PLACARDS

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.

All switches, lights, controls, adjustments, and circuit breakers, etc., must be marked with labels identifying their purpose and what their activation or use produces.

The convention for electrical switches is up for "on" and down for "off". Circuit breakers should be labeled to identify their rating, i.e. "5 Amp", "35 Amp", etc.

REQUIRED PLACARDS

There are four placards which must be installed:

1. The word "EXPERIMENTAL" must be placed where it can be prominently seen upon entry into the cabin. These letters must be at least 3 inches high, and contrast sufficiently to be seen on entry.
2. Passenger Warning Statement. The passenger warning statement should contain the following wording:

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

3. The following statement about flight into known icing conditions:

   Flight into known icing is prohibited.

4. Near each door latch:

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

RECOMMENDED PLACARDS

These placards can be photocopied and laminated if desired, and then pasted in a suitable location by the owner. It is recommended that all switches and circuit breakers be labeled - a Dymo® label maker, permanent marker, or similar, works well for this task. Further it is desirable to place all labels and placards such that all text is visible by the pilot. Placards indicating “Seat belt must be installed” and door opening placards should be visible by all occupants of the aircraft.

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

Emergency Procedures

Section III
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The following checklists are presented in a compact format. Those procedures requiring immediate action should be committed to memory and reviewed periodically using the cockpit to become familiar with locations of all controls and switches as well as checklist flow patterns. This checklist should be readily accessible in flight for quick reference if needed. In any emergency, aircraft control should be your first priority. Be aware that each situation will have its unique aspects which should be approached using good judgment and common sense.

FALSE START / HUNG START

Power Control Lever.....IDLE
Fuel Condition Lever.....CUTOFF
Start Switch .....OFF
Fuel Pump .....ON THEN OFF AT 10% NG
Ignition Switch .....OFF
Fuel Drain Period.....30 SECONDS
Dry Motor .....15 SECONDS (BEFORE START)

ENGINE FIRE ON START/SHUTDOWN

Fuel Condition Lever.....CUTOFF
Ignition Switch .....OFF
Start Switch.....ON
Fuel Selector Valve.....CHECK OPEN
Fuel Pump .....CHECK ON THEN OFF AT 10% NG (PROVIDES LUBRICATION TO THE ENGINE DRIVEN FUEL PUMP ELEMENTS)
Start Switch.....OFF (FIRE OUT OR STARTER LIMIT)

IF FIRE PERSISTS

Fuel Pump .....OFF
Fuel Selector Valve.....OFF
Battery Switches .....OFF
Exit Aircraft

FIRE ON THE GROUND

Power Control Lever.....IDLE
Propeller Control Lever .....FEATHER
Fuel Condition Lever.....CUTOFF
Fuel Selector Valve.....OFF
All Switches.....OFF
Exit Aircraft

ENGINE FAILURE DURING TAKEOFF ROLL

Power Control Lever.....IDLE
Brakes .....AS REQUIRED TO STOP

IF COLLISION IS LIKELY

Fuel Condition Lever.....CUTOFF
Fuel Selector Valve.....OFF
Battery Switches .....OFF

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

Pitch to Glide Attitude .....110 KIAS
Propeller Control Lever .....FEATHER
Fuel Condition Lever.....CUTOFF
Power Control Lever.....IDLE
Fuel Selector Valve.....OFF
Concentrate on Landing

ERRATIC OR UNRESPONSIVE ENGINE OPERATION

Fuel Selector Valve.....CHECK ON, SWITCH TO FULLEST TANK
Power Control Lever.....MID RANGE
Propeller Control Lever .....FULL FORWARD
Fuel Condition Lever.....LOW IDLE
Emergency Fuel Control Pin.....PULL
Emergency Fuel Control .....OPERATE SLOWLY

CAUTION

Pushing the lever increases power, monitor ITT to prevent overtemp, the Power Control Lever may have to be reduced to idle for landing.

ENGINE FIRE/MECHANICAL FAILURE AIRBORNE

Pitch to Glide Attitude .....110 KIAS
Propeller Control Lever .....FEATHER
Fuel Condition Lever .....CUTOFF
Power Control Lever.....LOW IDLE
Fuel Selector Valve.....OFF

NOTE

If smoke is present in the cabin, shut off all equipment operated by engine bleed air.

Perform Forced Landing Procedure

AIRSTART PROCEDURES

WARNING

Do not attempt to restart a failed engine caused by a known mechanical failure (Ng – 0%) or engine fire if Ng is above 50%.

ENGINE FLAMEOUT IF Ng IS ABOVE 50% (HOT AIR START)

Check Fuel Quantity .....SWITCH TO FULLEST TANK
Power Control Lever.....IDLE
Ignition.....ON
Fuel Condition Lever .....CHECK ON
Ng / ITT.....MONITOR

WHEN ENGINE RELIGHTS (ABOVE 51% Ng AND 400°C ITT)

Ignition.....OFF
Power Control Lever.....AS REQUIRED
Land at Nearest Suitable Airfield & Investigate

WARNING

During airstarts above 14,000' or with Ng<10%, starting temperatures tend to be higher and caution is required, if Ng is below 50%.

AIRSTART IF Ng is < 10% (COLD START)

Airspeed ..... 110 KIAS (90 KIAS MINIMUM, 260 KIAS MAXIMUM)
Power control Lever ..... IDLE
Fuel Condition Lever ..... CUTOFF
Gen/Alt/Non-Essential Equipment .... OFF
Battery Switches ..... ON
Fuel Selector Valve ..... ON, SWITCH TO FULLEST TANK
Fuel Pump ..... ON (CHECK 5 PSI MINIMUM, Ng 12% MINIMUM)
Ignition Switch ..... ON
Fuel Condition Lever ..... GROUND IDLE, AFTER 5 SECONDS STABILIZED Ng
ITT ..... MONITOR (1090 °C MAXIMUM FOR 2 SECONDS)
Power Control Lever ..... AS REQUIRED
Land at the Nearest Airfield
If Unable to Restart ..... USE AIRSTART WITH STARTER ASSIST PROCEDURE

AIRSTART (WITH STARTER ASSIST, Ng < 10%)

Fuel Condition Lever ..... CUTOFF
Power Control Lever ..... IDLE
Gen/Alt/Non-Essential Electrical Systems ..... OFF
Battery Master Switches ..... CHECK ON
Fuel Selector Valve ..... ON, SWITCH TO FULLEST TANK
Fuel Pump ..... ON (CHECK 5 PSI MINIMUM)
Ignition ..... ON
Start Switch ..... ON
Fuel Condition Lever ..... ON, AFTER 5 SECONDS STABILIZED Ng > 12%

WHEN ENGINE RELIGHTS (ABOVE 51% Ng AND 400°C ITT)

Starter ..... OFF
Ignition Switch ..... OFF
Power Control Lever ..... AS REQUIRED
Land at the nearest suitable airfield & Investigate
If unable to restart ..... PERFORM THE FORCED LANDING CHECKLIST

FORCED LANDING

The use of gear UP versus gear DOWN is a function of the type of landing site. If the site is relatively hard and smooth, a gear DOWN landing is recommended. Conversely, if the site is soft or rough, a gear UP landing is recommended. This procedure can be used for practice, and actual engine failure or a precautionary landing.

NOTE

For feathering, a minimum oil pressure of 15 psi should be registered if propeller is windmilling.

Landing Gear .....UP
Flaps.....UP
Propeller Control Lever .....FEATHER
Airspeed.....100KIAS

The above configuration should give maximum glide performance with approximately 500 fpm descent and an 18:1 glide ratio. This should result in approximately 3.5 nm glide distance per 1000' of altitude lost.

Fly Directly to Intended Landing Site
Fuel Pump Switch.....OFF
Ignition Switch.....OFF
Fuel Condition Lever.....CUTOFF
Power Control Lever.....IDLE
Fuel Selector Valve.....OFF
Cabin/Baggage Door Seal Switches ..OFF

Enter Forced Landing Pattern Overhead at high/low key whichever altitude permits, using an initial aim point 1/3 of the way down the runway/intended landing site. Use approximately 2500' AGL for High Key altitude and approximately 1300' AGL for Low Key altitude with the propeller feathered. If unable to feather the propeller, use 3500 AGL for High Key and 1700 AGL for Low Key.

Flaps.....24° AT LOW KEY
Gear.....DOWN, WHEN LANDING SITE APPEARS ASSURED
Flaps.....FULL, WHEN THERE IS NO DOUBT ABOUT LANDING SITE
Battery Switches.....OFF
Flare & Land.....BE AWARE OF HIGHER DESCENT RATES AND THE NEED TO FLARE EARLIER

PROPELLER OVERSPEED

Power Control Lever.....IDLE
Oil Pressure.....CHECK
Propeller Control Lever.....REDUCE RPM
Airspeed.....REDUCE
Power Control Lever.....AS REQUIRED TO MAINTAIN RPM
If overspeed was significant or vibration is experienced, Land at the Nearest Suitable Airfield

PRESSURIZATION SYSTEM MALFUNCTION

Differential Pressure Exceeds 6.5 psi:
- Cabin Pressure Dump Switch.....DUMP
- Oxygen Masks.....DON & ACTIVATE
- Emergency Descent.....EXECUTE

Sudden Loss of Pressure:
- Cabin Pressure Gauge.....CHECK CABIN ALT/PRESS DIFFERENTIAL
- Cabin Pressure Dump.....CHECK OFF
- Bleed Air.....ON
- Cabin Entry/Baggage Door Seal Switches.....CHECK ON
- Cabin Pressure Control.....CHECK SETTINGS
- Emergency Descent.....EXECUTE, IF CABIN ALTITUDE CONTINUES TO RISE
- Oxygen Masks.....DON & ACTIVATE

SMOKE/CONTAMINATION IN CABIN

Cabin Pressure Dump .....DUMP
Bleed Air.....OFF
Vent/Defog Fan.....ON
Emergency Descent .....EXECUTE
Oxygen Masks .....DON & ACTIVATE
Smoke Hood.....DON IF AVAILABLE
Fresh Air Valve (If Equipped on the
Aircraft .....PULL THE AUX HEAT KNOB TO FULL (AFT) POSITION TO ALLOW FRESH AIR FLOW INTO THE CABIN
Land at Nearest Suitable Airfield

ELECTRICAL FAILURES

Generator Failure: (High Amps, Low Bus Voltage)
Ammeter .....CHECK SYSTEM PAGE ON THE MFD TO VERIFY FAILURE
Generator Switch .....OFF
Starter/Generator Circuit Breaker...CHECK & RESET
Electrical Load.....REDUCE (SHED NON-ESSENTIAL LOADS SUCH AS AIR CONDITIONING, LANDING LIGHTS, ETC.)
Generator.....ON
If Generator Operation is not restored:
Generator Switch .....OFF
Land at Nearest Suitable Airfield

CAUTION

With the generator inoperative, battery power should last approximately 45 minutes with all non-essential electrical equipment disabled. When possible, turn the battery switches OFF to conserve electrical power and back ON for landing. If total electrical failure is experienced, it will be necessary to perform an Emergency Gear Extension and land without flaps.

Electrical System Circuit Breakers

Component	Breaker (Amp)	Typical Draw (Amp)
Circuit Breaker Panel		
Hydraulic Pump	35	23.5
Propeller Heat (E*)	35	23.5
Fuel Pump (E)	15	10
Flaps	10	6.7
Generator (E)	10	6.7
Pitot Heat (E*)	10	6.7
Auto Pilot (E)	7.5	5
Ignition (E)	5	3.5
Start	5	3.5
Pneumatic Heat (E)	5	3.5
Transponder (E)	5	3.5
PFD (E)	5	3.5
GPS1 (E)	5	3.5
Com1 (E)	5	3.5
MFD (E)	5	3.5
GPS2	5	3.5
Com2	5	3.5
AHRS (E)	5	3.5
Radiant (Moritz) (E)	3	2
Trim (E)	3	2
Gear Relay	2	1.5
ATT Gyro (E)	2	1.5
Touch Screen Circuit Breakers		
Air Conditioning	20	13.5
Fan Power	10	6.7
Nav Light	5	3.5
Strobe	5	3.5
Landing	5	3.5
Cabin Lights	5	3.5
Panel Lighting	3	2
Wig Wag	1	0.7

E – Essential Equipment (leave on)

* May be essential.

LOW FUEL PRESSURE

Record time that fuel pressure is less than 35 psi for engine records.

LOW OIL PRESSURE (<75 PSI)

(Do not change power setting or engine seizure may occur)

Engine RPM (Ng) .....CHECK ABOVE 72%
Torque (lbs).....MAINTAIN MINIMUM NEEDED UNTIL FIELD IS ASSURED

Land at Nearest Suitable Airfield

LOW OIL PRESSURE (<40 PSI)

(Do not change power setting or engine seizure may occur)

Land at Nearest Suitable Airfield Using Minimum Power Setting
(Consider entering a HIGH Key position for a precautionary Forced Landing pattern.)

HIGH OIL PRESSURE (>105 PSI)

Land at Nearest Suitable Airfield Using Minimum Power Setting

LOW OIL TEMPERATURE (<0 DEG C)

Fuel ..... MONITOR PSI & FLOW
Electric Fuel Pump.....ON/CHECK ON

NOTE
Fuel heater operation not guaranteed.

HIGH OIL TEMPERATURE (>99 DEG C)

Power Setting.....REDUCE AS NECESSARY
Land at Nearest Suitable Airfield

HYDRAULIC SYSTEM MALFUNCTION

Whenever extending/retracting the landing gear, monitor the HYD PUMP light for operation, listen for pump operation, and feel for gear retraction/extension. If the pump fails there will be no HYD PUMP light or noise from the pump. If the pressure switch fails, the pump will either not run or run continuously. If both the solenoids are off because of no power, the gear will remain retracted if the counter balance valve is adjusted properly or drop out of the wheel well if it is not. If both solenoids are on (failure of gear switch), the gear will drive down slowly and lock. To extend the gear with any of the above malfunctions, use the EMERGENCY GEAR EXTENSION Procedure.

EMERGENCY LANDING GEAR EXTENSION

Landing Gear Lights ..... TEST (SET TO DAY POSITION)

IF LIGHTS TEST GOOD & ONE OR MORE GEAR INDICATE UNSAFE

Airspeed ..... BELOW 140 KIAS
Landing Gear Handle ..... DOWN

IF THE LANDING GEAR DOES NOT GO DOWN

Airspeed ..... 140 KIAS OR LESS
HYD PUMP Circuit Breaker ..... PULL
GEAR SWITCH Circuit Breaker ..... PULL
Emergency Gear Extension Valve ..... ROTATE CLOCKWISE
Landing Gear Position Lights ..... CHECK INDICATIONS

IF LEFT MAIN GEAR STILL UNSAFE

Aircraft ..... YAW LEFT AND HOLD
Airspeed ..... REDUCE TO 90 KIAS

IF RIGHT MAIN GEAR STILL UNSAFE

Aircraft.....YAW RIGHT AND HOLD
Airspeed.....REDUCE TO 90 KIAS

IF NOSE GEAR STILL UNSAFE

Aircraft.....PITCH APPROXIMATELY 10° NOSE HIGH AT APPROXIMATELY 2 G'S (REPEAT IF NECESSARY)
Airspeed.....REDUCE TO 90 KIAS

NOTE

Once the landing gear is extended, it is not recommended that it be retracted again before landing and determining the cause of failure.

CAUTION

Observers for determining gear status should be used with caution. Air & ground observation is not always reliable and observers might not be familiar with the Lancair landing gear in its down & locked configuration. Not all pilots are formation qualified and should be used with caution.

FLAP SYSTEM MALFUNCTION

Airspeed.....140 to 160 KIAS
Flap Circuit Breaker.....CHECK IN
Check that Flap Indicator and Flap
Position Agree. If there is an
Asymmetry and/or
Rolling Moment.....RETRACT FLAPS

CAUTION

Higher than normal approach speeds will be required without flap extension. Add 10 KIAS to all pattern speeds and be aware that higher deck angles and longer landing distances will result.

EMERGENCY SPEED REDUCTION

NOTE

The nature of the emergency should be considered before taking this action.

Power Control Lever.....IDLE
Pitch Attitude.....INCREASE TO CLIMB, SITUATION PERMITTING
Landing Gear.....EXTEND BELOW 150 KIAS
Flaps.....FULL EXTEND BELOW 140 KIAS
When Target Speed is Obtained:
Gear.....UP
Flaps.....UP

EMERGENCY DESCENT

Power Control Lever.....IDLE
Propeller Control Lever .....FORWARD
Airspeed .....160 KIAS
Flaps.....APPROACH
Gear.....DOWN
Airspeed .....140 KIAS
Flaps.....FULL
Airspeed .....TRIM & MAINTAIN 135 KIAS
Expect 3500 to 4000 fpm rate of descent.

UNLATCHED DOOR IN FLIGHT

If the door becomes unlatched or opens in flight the first priority is to "FLY THE AIRPLANE". If the door is still hooked, have a passenger hold the handle to prevent further opening, if the door has completely opened do not attempt to close it. Slow the airplane down to approach speed, extend the flaps and return to the nearest suitable airfield and land.

EMERGENCY GROUND EGRESS

Engine .....SHUTDOWN, IF RUNNING
Emergency Power Level (EPL).....IDLE
Propeller.....FEATHER
Fuel Control .....OFF
Lap Belt/Shoulder Harness .....RELEASE
Main Entry/Baggage Door Seals .....DEFLATE
Battery Switches .....OFF
Fuel Selector Valve.....OFF
Main Entry Door.....UNLATCH & OPEN
Exit Aircraft

INADVERTANT ICING ENCOUNTER

Pitot Heat .....ON
Propeller De-Ice .....ON
Engine Ice Door .....BYPASS
Windshield Defrost .....ON
Vent/Defog Fan.....ON
Wing and/or Windshield De-Ice .....ON
Heading/Altitude.....CHANGE TO EXIT ICING CONDITIONS

SPIN RECOVERY

Power Control Lever.....IDLE
Control Stick .....NEUTRAL TO SLIGHTLY FORWARD, AILERONS NEUTRAL
Rudder.....FULL OPPOSITE TO ROTATION
Rudder, When Rotation Stops .....NEUTRAL
Pitch .....DOWN, RECOVER AIRSPEED
Recover Smoothly From Ensuing Dive, Remaining Within Aircraft G Limits.

MAXIMUM GLIDE CONFIGURATION

Gear.....UP
Flaps.....UP
Propeller.....FEATHER
Airspeed.....110 KIAS

The above configuration should give maximum glide performance with approximately 500 fpm descent and an 18:1 glide ratio.

Glide distance is approximately 3.5 nm per 1000 feet of altitude loss, however this may vary significantly. It is suggested that it be established for your individual aircraft.

Normal Procedures

Section IV
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SAFE OPERATING AIRSPEEDS

NOTE

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

Max Demonstrated X-WIND component	25
Rotate Speed (V_R) with flaps 24 deg.	65-80
Best Angle of Climb (V_X)	85
Best Rate of Climb (V_Y)	105
Cruise Climb	140-160
Stall Speed clean (V_S)	76
Stall Speed Landing config. (V_{SO})	61
Landing Gear Operating Speed (V_{LO})	150
Landing Gear Extended Speed (V_{LE})	165
Approach Flaps Extended	160
Full Flaps	140

PRE-FLIGHT INSPECTION

COCKPIT CHECK

Aircraft Status Log.....CHECKED
Required Forms/Certificates.....ON BOARD/CHECKED
All Electrical Switches.....OFF/NORMAL
Circuit Breakers.....CHECK IN
Gear Handle.....DOWN
Battery Master Switch.....ON
Aircraft Battery.....CHECK 24 VOLTS MIN
Fuel Gauge.....CHECK QUANTITY, BALANCE & RESET
Fuel Selector.....FULLEST TANK
Oxygen Quantity.....CHECK
Trim Servos.....CHECK
Flaps.....DOWN
Pitot Heat Cover.....REMOVE/STOWED
Pitot Heat.....ON (10 SEC)

Pitot Tube.....VERIFY WARM AND CHECK CONDITION
Exterior Lights .....ON & CHECK
Pitot Heat .....OFF
Battery Switch.....OFF
Propeller Heat .....ON FOR 30 SECONDS, CHECK BLADES FOR HEAT

LEFT FUSELAGE

Main Entry Door.....CLOSE AND CHECK EXTERNALLY
Step .....SECURE
Rear Window .....CHECK CONDITION
Upper and Lower Antennas .....CHECK CONDITION
Static Port.....CLEAR
A/C Vent .....SCREEN CLEAR
Horizontal Stabilizer/Elevator .....UPPER/LOWER SURFACES, ATTACH POINTS, FREE
Elevator Trim Tab.....SECURE, ATTACH POINTS, FREE
Rudder.....CONDITION, ATTACH POINTS, FREE

RIGHT FUSELAGE

Horizontal Stabilizer/Elevator.....UPPER/LOWER SURFACES, ATTACH POINTS, FREE
Baggage Door .....CLOSED & LOCKED
Static Port.....CLEAR
Windows .....CHECK CONDITION

RIGHT WING

Right Main Gear Door .....CONDITION, ATTACH POINTS
Right Main Gear Mount.....CHECK ATTACH POINTS, HYDRAULIC & BRAKE LINES/PADS, EXTENSION (4" MINIMUM)
Right Main Tire.....CONDITION, INFLATION
Right Flap.....ATTACH POINTS, MOVEMENT
Aileron Push Rod.....CHECK CONNECTION (INSIDE WING)
Right Aileron .....ATTACH POINTS, FREE
Nav / Strobe Lights .....CONDITION, SECURE

Fuel Tank Vent .....CLEAR
Right Fuel Tank Cap.....VISUALLY CHECK FUEL & SECURE
Leading Edge/Stall Strips .....CONDITION, SECURE
Underwing Panels .....SECURE
Fuel Sump Drain.....SAMPLE
Wing Root Fairing .....SECURE

NOSE

Cowling.....SECURE
Propeller Hub/Blades.....CONDITION, SECURE, LEAKAGE, FREE
Propeller Spinner .....SECURE
Exhaust Stacks .....CONDITION, COVERS REMOVED
Engine Intakes.....CLEAR
Nose Gear Strut.....CONDITION, EXTENSION (4" MINIMUM)
Nose Gear Tire.....CONDITION, INFLATION
Landing Light.....CONDITION
Oil Level .....CHECK
Oil Cap & Door.....SECURE
Windshield .....CHECK CONDITION

LEFT WING

Wing Root Fairing.....SECURE
Fuel Sump Drain.....SAMPLE
Underwing Panels .....SECURE
Leading Edge/Stall Strips .....CONDITION, SECURE
Left Fuel Tank Cap .....VISUALLY CHECK FUEL AND SECURE
Pitot Tube.....CONDITION, SECURE, WARM
Fuel Tank Vent .....CLEAR
Nav/Strobe Lights .....CONDITION, SECURE
Left Aileron.....ATTACH POINTS, FREE
Aileron Trim Tab .....SECURE, ATTACH POINT
Aileron Push Rod.....CHECK CONNECTION (INSIDE WING)
Left Flap.....ATTACH POINTS, MOVEMENT
Left Main Tire.....CONDITION, INFLATION

Left Main Gear Mount.....CHECK ATTACH POINTS, HYDRAULIC & BRAKE LINES/PADS, EXTENSION (4" MINIMUM)
Left Main Gear Door .....CONDITION, ATTACH POINTS

BEFORE ENGINE START

Wheel Chocks.....REMOVED
Seat Belts/Shoulder Harness.....ADJUSTED & LOCKED
Passenger Brief .....COMPLETE
Emergency Gear Extension Valve.....VERTICAL
Emergency Fuel Control Knob .....FULL AFT & PINNED
Fuel Condition Lever.....CUTOFF
Propeller Control Lever .....FEATHER
Power Control Lever.....IDLE (OUT OF BETA)

CAUTION

Do not move the power control lever into the reverse range (Beta) before engine start, as damage to the linkage will result. Reverse (Beta) may only be selected with the engine running and the propeller turning.

WARNING

Stabilized ground operation within the propeller restricted RPM range (400 to 1200 RPM Np) can generate high propeller stresses and result in failure and loss of control of the aircraft.

ENGINE START

Cabin Door.....CLOSED & LATCHED
Cabin/Baggage Door Seal Switches ..ON (LISTEN FOR PUMPS AND FOR PUMP SHUTOFF)
Standby Gyro Cage Knob .....PULL & HOLD
Battery Switch.....ON, 24V MINIMUM (RELEASE GYRO CAGE KNOB)
Landing Gear Light Test Switch.....TEST & CHECK LIGHTS
Check Brakes .....ENGAGED
Start Area .....CLEAR
Ignition Switch.....ON, LISTEN FOR FIRING, OFF

Fuel Pump Switch.....ON (35 PSI MINIMUM)
Engine Start Switch.....START & HOLD

NOTE
Minimum speed for satisfactory light is 12% Ng

Engine Oil Pressure.....CHECK INCREASING
Ignition Switch.....ON
Fuel Condition Lever.....IDLE AFTER Ng EXCEEDS 12%
ITT (Monitor for light-off).....10 SECONDS MAXIMUM (880 °C, 1090 °C FOR 2 SECONDS)

CAUTION

If there is no lightoff within 10 seconds after moving the fuel condition lever to the idle position, shut off the starter and ignition, and allow a 30 second fuel drain period followed by a 15 second dry motor run before attempting another start.

Engine Start Switch.....OFF WHEN ENGINE ATTAINS IDLE RPM (Approximately 52%)
Ignition Switch.....OFF
Engine Instruments.....OIL PRESSURE 40 PSI MINIMUM, OILTEMPERATURE -40 °C TO 99 °C
Generator Switch.....ON (CHECK VOLTAGE, 27V MINIMUM)
Ground Power Unit.....DISCONNECT
Propeller Control Lever.....CYCLE TWICE (FIRST FLIGHT OF THE DAY)
Bleed Air.....ON/VERIFY ON

WARNING

Stabilized ground operation within the propeller restricted RPM range (400 to 1200 RPM Np) can generate high propeller stresses and result in failure and loss of control of the aircraft.

Propeller Control Lever.....FORWARD

TAXI

Systems Controller.....SELECT DESIRED LIGHTS, FAN, AND AIR CONDITIONING
Pressurization.....ON & SET
Avionics and Instruments .....SET
Brakes .....CHECK THEN RELEASE UPON TAXI. CHECK FOR CORRECT STEERING RESPONSE LEFT AND RIGHT
Flaps.....SET FOR TAKEOFF (24°)

BEFORE TAKEOFF

Flight Controls .....FREE & CORRECT
Fuel Selector .....FULLEST TANK
Flaps.....CHECK
Trim.....SET – TAKEOFF RANGE
Auto Pilot.....OFF – PRESET BAROMETER AND FIELD ELEVATION (TRUTRAK)
Pressurization.....SET & DUMP SWITCH CLOSED
Fuel Condition Lever .....GROUND IDLE
Power Control Lever.....ADVANCE TO 1500 Np
Propeller Control Lever .....CYCLE (FORWARD/FEATHER/FORWARD)

Overspeed Governor Test
(Push Button Switch) .....CHECK (BEFORE TAKEOFF OR AFTER MAINTENANCE)

1. Propeller Control.....FULL FORWARD
2. Power Control Lever.....Np TO 1500 RPM
3. Prop Gov Test Switch.....ON (HOLD)
4. Power Control Lever.....INCREASE (CHECK FOR Np GOVERNING BETWEEN 1750 AND 1850 RPM)
5. Power Control Lever.....Np BELOW 1500 RPM
6. Prop Gov Test Switch.....RELEASE

Overspeed Governor Test
(Radiant (Moritz) Touch Screen).....CHECK (BEFORE TAKEOFF OR AFTER MAINTENANCE)

1. Propeller Control.....FULL FORWARD
2. Governor Test Switch.....TOUCH TO ENABLE OS GOV TEST

3. Power Control Lever.....ADVANCE TO ACHIEVE Np OF 1900 RPM
4. Np Observe .....MAX Np OF 1750 RPM
5. After 30 Seconds
   Power Control Lever.....ADVANCE TO 1900 RPM
6. Power Control Lever.....REDUCE TO IDLE

Power Control Lever.....IDLE & CYCLE (IDLE/BETA/IDLE)
Flight Instruments .....CHECKED & SET, FOR DEPARTURE
EFIS .....PROGRAMMED, FOR DEPARTURE & FLIGHT PLAN
Ignition.....ON
Bleed Air.....ON
Landing Light.....ON
Transponder .....SET
Radios .....SET
Pitot Heat .....AS REQUIRED
Propeller De-Ice .....AS REQUIRED
Takeoff Brief.....COMPLETE

TAKEOFF

Power .....SMOOTHLY SET 1248 FT/LBS TORQUE MAXIMUM UNTIL AIRBORNE
Rotate .....65 TO 80 KIAS
Gear.....UP, WHEN SAFELY AIRBORNE AND POSITIVE RATE OF CLIMB
Climb.....MAINTAIN 95 KIAS TO 1000' AGL, LOWER NOSE & ACCELERATE
Flaps.....UP (120 KIAS)
Accelerate to Climb Speed.....145 KIAS

AFTER TAKEOFF/CLIMB

Landing Gear/Flaps.....RECHECK UP
Power .....SET
- ITT .....805 °C MAXIMUM
- Ng.....101.6% MAXIMUM
- Np.....1900 RPM MAXIMUM
- Torque.....1940 ft lbs. MAXIMUM
- Oil Pressure.....85 TO 105 PSI

Oil Temperature.....10 °C TO 99 °C
Ignition.....OFF
Landing Light.....OFF
Climb Set .....150 TO 160 KIAS
Altitude Select.....SET FOR INITIAL CLIMB
Pressurization.....CHECK & MONITOR
Fuel Balance.....MONITOR

CRUISE

Engine Instruments .....MONITOR
Fuel Quantity .....MONITOR & MAINTAIN BALANCED
Pressurization.....MONITOR

DESCENT

Pressurization.....SET TO ANTICIPATED LANDING FIELD ELEVATION
EFIS .....ARRIVAL/APPROACH SELECTED
Fuel Quantity .....CHECK/BALANCE
Altimeter .....SET
Defog.....AS REQUIRED
Pitot Heat .....AS REQUIRED
Propeller De-Ice .....AS REQUIRED

BEFORE LANDING

Fuel Selector .....FULLEST TANK
Ignition.....ON
Flaps.....24°, BELOW 160 KIAS
Landing Gear .....DOWN, BELOW 150 KIAS
Landing Lights.....ON
Parking Brake.....OFF
Brakes .....TEST
Flaps.....FULL (48°), BELOW 140 KIAS
Landing Gear .....RECHECK DOWN
Trim.....SET
Pattern Speeds (Minimum)
Downwind.....100 KIAS
Base.....90 KIAS
Final .....80 KIAS

GO AROUND/BALKED LANDING

Power Control Lever.....APPROXIMATELY 1248 FT/LBS TORQUE
Flaps.....RETRACT TO 24°
Landing gear .....UP, WHEN SAFELY AIRBORNE WITH POSITIVE RATE OF CLIMB
Climb.....MAINTAIN 95 KIAS TO 1000' AGL THEN LOWER THE NOSE AND ACCELERATE
Flaps.....UP, BEFORE 120 KIAS
Accelerate to Climb Speed.....145 KIAS

TOUCH AND GO LANDING

Flaps.....RESET TO 24°
Trim.....RESET
Power Control Lever.....SMOOTHLY ADVANCE TO APPROXIMATELY 1248 FT/LBS TORQUE
Rotate .....65 TO 80 KIAS
Landing Gear .....UP, WHEN SAFELY AIRBORNE AND POSITIVE RATE OF CLIMB
Climb.....MAINTAIN 95 KIAS TO 1000' AGL THEN LOWER THE NOSE AND ACCELERATE
Flaps.....UP, AT 120 KIAS
Accelerate to Climb Speed.....145 KIAS

AFTER LANDING

Flaps.....UP
Trim.....RESET
Landing Lights.....OFF
Ignition.....OFF
Pitot Heat .....OFF
Transponder .....STANDBY
Cabin Pressurization Switch .....DUMP

ENGINE SHUTDOWN

Power Control Lever.....IDLE

NOTE

Allow the engine to stabilize a minimum of one minute at the minimum obtainable ITT.

Power Control Lever.....IDLE (OUT OF BETA)
Generator Switch .....OFF
Propeller Control Lever .....FEATHER
Fuel Pump Switch.....LEAVE ON
Radiant (Moritz) Control .....SET, SYSTEMS OFF
Fuel Condition Lever.....CUTOFF
Fuel Pump Switch.....OFF, AT 10% Ng
Cabin/Baggage Door Seal Switches ..OFF
Battery Switch.....OFF

POST FLIGHT

Chocks.....INSTALLED
Power Control Lever.....IDLE (OUT OF BETA)
Propeller Control Lever .....FEATHER
Fuel Condition Lever.....CUTOFF
Fuel Selector .....LEFT OR RIGHT TANK

CAUTION

Ensure the fuel selector is either in the left or right tank position. If the selector is "in between" the fuel in the higher wing will drain to the lower wing causing a dangerous imbalance condition. Also, fuel may dump through the vent system onto the ramp until the higher wing is completely empty.

Flaps.....UP
All Electrical Switches.....OFF
Control Locks.....INSTALLED
Fuel/Oil/Oxygen .....SERVICED, AS REQUIRED
Aircraft Forms.....UPDATED
Cabin/Baggage Doors .....CLOSED & LATCHED

Exterior Inspection.....AS REQUIRED
Pitot heat/Duct/Canopy Covers.....INSTALLED
Aircraft Tie-Downs.....SECURED
Aircraft Engine Log.....AS REQUIRED

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 Lancair aircraft 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 causing higher oil pressures, slower indication upon starting, poor battery performance, etc.

ICING CONDITIONS

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.

CAUTION
Flight in known icing conditions is prohibited.

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.

Weight and Balance

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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 attempt to use unverified aircraft 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 1500 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 121.9 to FS 129.6 (10.0% MAC to 28% 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 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 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.
2. Establish the "Reference datum point" (FS 0) from which ALL measurements can be made. The bottom firewall joggle is FS 51.25 and is easily located adjacent to the nose gear well. Drop a plumb bob line down from that point and mark it on the floor.
3. Establish an aircraft centerline on the floor by dropping a plumb bob point from the tail and "chalking" a line between the two points. Continue this line forward to locate FS 0 which is 78" forward of the front face of the firewall.

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. Next measure and record the distance from the Reference datum to the location of the nose and main gear as marked along the fuselage centerline. Refer to the Weight and Balance Data Sheet in Section VIII Supplements. Log these distances in the appropriate rows of the “Moment Arm” column.
6. Read and record the actual weights of the leveled aircraft on the three scales. Log these weights in the appropriate rows of the “Weight” column. Ensure your weight does not include the weights of any shim stock (the 1 x 4s and any other non-aircraft weight) that is on the scales.

You now have all the information required to establish the aircraft’s 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 the appropriate rows of the "Moment Weight" column.
2. Total the "Weight" and the "Moment Weight" separately and record them in the appropriate columns in the "Empty CG" row.
3. Divide the total Moment Weight by the total Weight 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 because when the pilot gets into the aircraft, he will be aft of this point which 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 i.e., at the front CG limit.

NOTE

The allowable Center of Gravity range is FS 121.9 to FS 129.6 (10.0% MAC to 28% MAC).

Before removing the aircraft from the scales, it is wise to also establish your exact moment arms for fuel and for front and rear seats. Builder differences in relation to the exact location of the wing can change the CG of the fuel, and the pilot and passenger moment arms are affected by such items as seat back angles, cushions, etc. These are less defined and should be determined, not estimated.

To determine your pilot/front seat passenger moment arm have someone sit in the plane and log the resultant weight changes on the three scales. Make sure the seats are slid forward to their normal "flight" position. Now recalculate the pilot's moment arm. Repeat this process for the rear passenger seats.

To determine the CG of the fuel tanks, simply add 10-20 Gal. of fuel in each tank, log the new weights and calculate the fuel CG.

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) and the main gear weight change by their respective 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 resulting number is the moment arm for your body. Log this dimension as the pilot/front seat passenger moment arm.

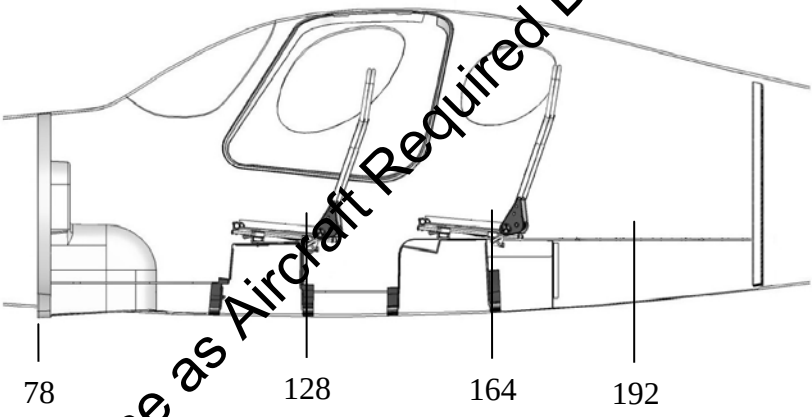
This approach can be used to accurately calculate the remaining loading points such as the rear passengers, fuel and baggage. It is recommended that this be done as this is the most accurate means of attaining a true loading analysis for your particular airplane. If you are measuring for fuel loads, use 6.8 lbs/gallon to calculate the weight.

USEFUL LOAD ARMS

The useful load is the combined weight of the pilot, co-pilot passengers, usable fuel, and baggage. It can be determined by subtracting the empty weight of the airplane from the maximum allowable gross weight. The following figure and table shows likely arms for the pilot, co-pilot, and baggage. The fuel arm is listed in the table, but not shown on the figure. Datum "0" is 78 inches in front of the firewall.

NOTE

The arms for the useful load of your aircraft may differ from those shown below.



Description	Arm (Inches From Datum)
Front Seat Pilot and Co-pilot	128 inches
Rear Seat Passenger(s)	164 inches
Fuel	136.375 inches
Baggage Area	192 inches

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SYSTEMS DESCRIPTIONS

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AIRFRAME

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

MATERIALS

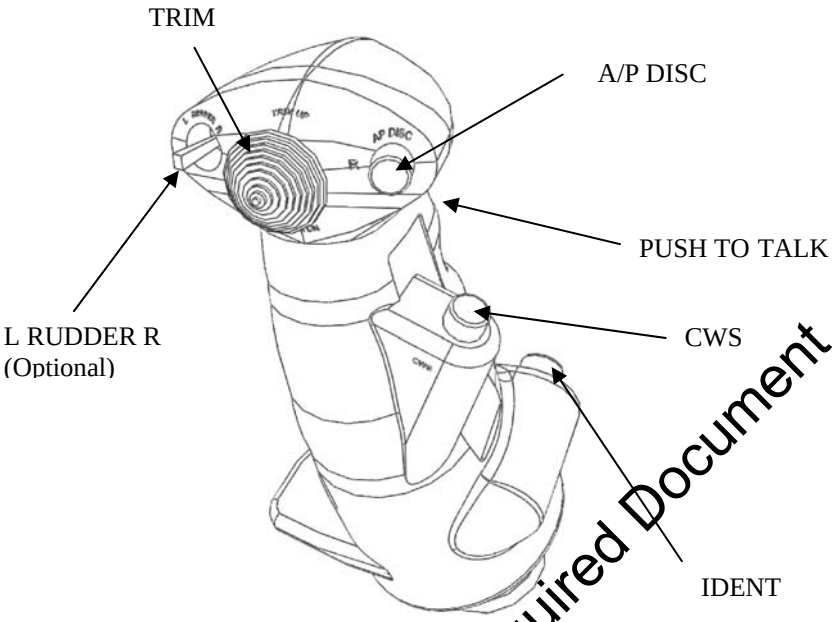
The aircraft is fabricated of high temperature prepreg Carbon Fiber skins over a high temperature Divinycell or Nomex Honeycomb core.

FLIGHT CONTROLS

The aircraft is conventional in its control configuration except for the side stick controls. Lancair's airfoils are a combination of NASA and NACA designs with our own unique airfoils designed specifically for the Lancair mission. All primary airfoils are High-Laminar flow designs with noncritical characteristics. This means that the airfoils are capable of maintaining laminar flow over 50-60% of their chord, generating greatly reduced drag. Should laminar flow be lost due to surface contamination (i.e. bugs, etc.) no dramatic loss of lift is incurred.

TRIM CONTROLS

The aircraft utilizes two axis electric trim. The elevator tab is built into the control surface and the aileron tab is hinged on the trailing edge of the left aileron. Trim controls are located on the pilot and co-pilot stick and are labeled for each axis.



Control Stick

Aileron Tab

Elevator Tab

GROUND CONTROL

The aircraft is controlled on the ground using differential braking to control the castering nose gear. A little caution for the first few flights in the aircraft is all that is required to get the feel of this simple and light weight approach. Use Beta to control the taxi speed. Caution should be exercised to not ride the brakes while taxiing, use only enough power to taxi at a brisk walking pace and try to only use the brakes as necessary for steering. Under normal conditions brakes are not needed for the take-off roll once the power is applied, as rudder control becomes effective above 25-30 kts.

FLAPS

The wing flaps are electrically operated. The flaps are actuated with the flap control switch located on the lower middle of the instrument panel. It is a three position switch. Turning the switch fully up will retract the flaps to 0°. Turning the switch to the middle position will extend the flaps to the takeoff/approach position of 24°. Turning the switch fully down will lower the flaps to the landing position of 48°.

Flap position is indicated on the MFD.

LANDING GEAR

The aircraft main landing gear is constructed of welded 4130 steel tubing. The main gear is retracted into the wing using actuators driven by the hydraulic system.

The nose gear is a conventional air/oil oleo strut with internal viscous shimmy dampening. Retraction is accomplished with a separate hydraulic cylinder and operated through the normal hydraulic system. A dedicated gas strut is used for emergency extension.

WARNING

The nose wheel shimmy dampener must be checked on a regular basis. Air/oil struts should have from 20-50 ft. pounds 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 axle bolt must be tightened.

The split nose gear doors are operated through the retract linkage and are held open by a gas strut in the same linkage.

GEAR OPERATION

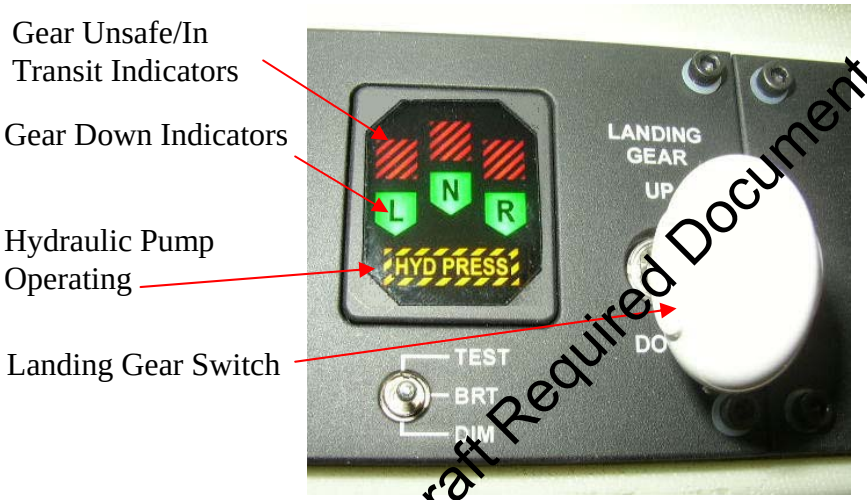
In the down position the nose gear is held in position by a locking actuator and a gas strut. The main gear are held in position by locking actuators.

Retraction of the gear is accomplished by moving the gear switch to the up position to activate the hydraulic pump. Hydraulic pressure unlocks actuating cylinders. However, the hydraulic pump will not activate if the aircraft is moving slower than approximately 80 mph. This is accomplished by a pitot pressure sensing switch and a relay in the hydraulic system. As the landing gear becomes fully retracted, the hydraulic system reaches its maximum pressure and a pressure switch shuts off the pump. The gear is held in the up position by hydraulic pressure.

Emergency extension of the landing gear is accomplished by placing the gear handle in the down position and using the

emergency by-pass valve located on the spar box between the pilot's legs. The main gear should fall and lock under their own weight, a gas shock strut is used to force the nose gear to the down and locked position.

GEAR OPERATION INDICATOR



Landing Gear Switch and Indicator

NOTE

The picture of the indicator, above, has <u>all</u> lights illuminated for illustration purposes only. Normal operation of the indicator is described below.

INDICATOR DISPLAY

Indicator Light	Landing Gear Position
Red	In Transition
Green	Down and Locked
Yellow	Hydraulic Pump Running
No Lights	Up

The red lights should be illuminated when the gear is in motion. The hydraulic pump will run until the gear either retracts into the

aircraft or extends down and locks, at which time the yellow "HYD PRESS" indicator will go off.

The “HYD PRESS” light also allows you to monitor exactly when and how long the hydraulic pump runs. It is an excellent safety feature in that it can indicate problems that you might not otherwise be aware of.

GEAR WARNING SYSTEM

The following gear warning system information applies to aircraft S/N 48 and on. It only applies to aircraft S/N 1 through 47 if they have been modified appropriately.

Gear Warning Speed (100-105 kts)

If the speed of the aircraft drops below the gear warning speed with the gear retracted, a buzzer will sound and all three gear unsafe lights will flash.

All gear unsafe lights flash.

The alerts will continue until one of the following conditions is met:

1. The airspeed is increased above the gear warning speed (100-105 kts)
2. All landing gear are extended to the full down and locked position.

Gear Warning, Flaps Full Down Position

The flap function is its own trigger for the gear warning system. Setting the flaps to the TAKEOFF position will not trigger the alarm. If the flaps are extended to FULL DOWN (landing) at any airspeed, the gear warning system will trigger and the alerts will activate. The alerts will continue until one of the following conditions is met:

1. The flaps are retracted from the FULL DOWN position and the airspeed is above 100-105 kts.
2. All landing gear are extended to the full down and locked position.

Gear Failure

If any of the landing gear are unsafe, such as the nose gear as shown below, the three red "unsafe" lights will flash and the audible alarm will sound. The gear warning system needs all three gear to be down and locked (three green lights) in order for the alerts to stop.

All of the gear unsafe lights flash.

Failed nose gear indicated.

Gear Warning on Takeoff

The rotation speed of the aircraft at takeoff is approximately 65-80 kts. Retracting the landing gear immediately after takeoff at airspeeds below 100-105 kts will trigger the gear warning system. Once the aircraft reaches airspeeds above 100-105 kts, the gear warning system alerts will stop.

Mute Switch
The gear warning system is integrated with a pushbutton mute switch located near the landing gear switch. This pushbutton silences the audible alert of the gear warning system, does not affect the three flashing red lights, and activates an 18 second timer. Muting the buzzer improves communication with the airport during an emergency. The mute switch may also be used during takeoff. After the 18 second timer expires the audible alert restarts. The mute cycle may be used as many times as necessary.

BAGGAGE COMPARTMENT

The baggage compartment is located directly behind the passenger seats. Its capacity should never exceed 225 pounds. The aircraft weight and balance may limit the maximum baggage to less than the maximum stated herein.

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

WARNING

Anticipate the likelihood of negative flight conditions for every flight!

SEATS, SEAT BELTS AND SHOULDER HARNESS

Your Lancair is fitted with seat belts and 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 should always remain

belted throughout the flight - immediate control of the machine is important.

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.

CONTROL LOCKS

A standard flight control lock strap (P/N 218-0009) is recommended and available through Lancair. An alternative control lock for the Evolution is to use 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 boards 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 a span-wise spoiler 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 prevent.

ENGINES

GENERAL INFORMATION

The aircraft has been designed for a Pratt & Whitney PT6A-135(A) engine and a Hartzell constant speed propeller.

ENGINE CONTROLS

Power Control Lever – Used to control the amount of power being delivered by the engine. Additionally, it can be used to

put the propeller into beta by engaging the detent and pulling the lever rearward.

Propeller Control Lever – Connected to the propeller governor. It is used to maintain engine/propeller RPM at a selected value by controlling blade angle. Pulling the lever to the rear will feather the propeller.

Condition Lever – This control completely cuts off fuel for engine shutdown when pulled to the rear. Moving the control lever to the "Idle Detent" allows fuel to flow to the FCU. Increasing (move forward) the condition lever to the flight idle position increases the idle speed.

ENGINE INSTRUMENTATION

Engine instrumentation is provided by Garmin G900X avionics suite. Refer to the latest revision of the G900X manual for operation.

ACCESSORIES

This engine is equipped with a starter/generator as a source of electrical power to charge the 2 batteries and operate various items during flight. Proper operation of the charging system is evident if the running system voltage is between 28.4 and 28.8 volts DC.

Since a charged lead-acid battery has a voltage of 24.2 to 24.8 volts the battery should be continuously charging while the engine is running.

FIRE DETECTION/EXTINGUISHING

No built in fire detection is 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.

ABNORMAL OPERATION

After a few hours of operating your Lancair aircraft 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 need watching.

Continuous monitoring of engine parameters such as oil pressure, Ng, Np, ITT, fuel flow and fuel pressure (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.

PROPELLERS

The Lancair Evolution is designed to use either the Hartzell, HC-E4N-3NX/D8292BX*2, 4 bladed constant speed propeller or the MT-Propeller, MTV-27-1-E-C-R(P)CF8280-58d, 5 bladed constant speed propeller.

NOTE

Contact Lancair International Inc. for other approved propellers other than those indicated above.

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 through many hours of flight. If in doubt, have it inspected by a certified propeller repair facility.

FUEL SYSTEM

The fuel system feeds fuel to the engine through a fuel screen pickup, fuel selector, gascolator/fuel filter, electric boost pump, and finally a fuel control unit. The fuel tanks should be sumped at regular intervals.

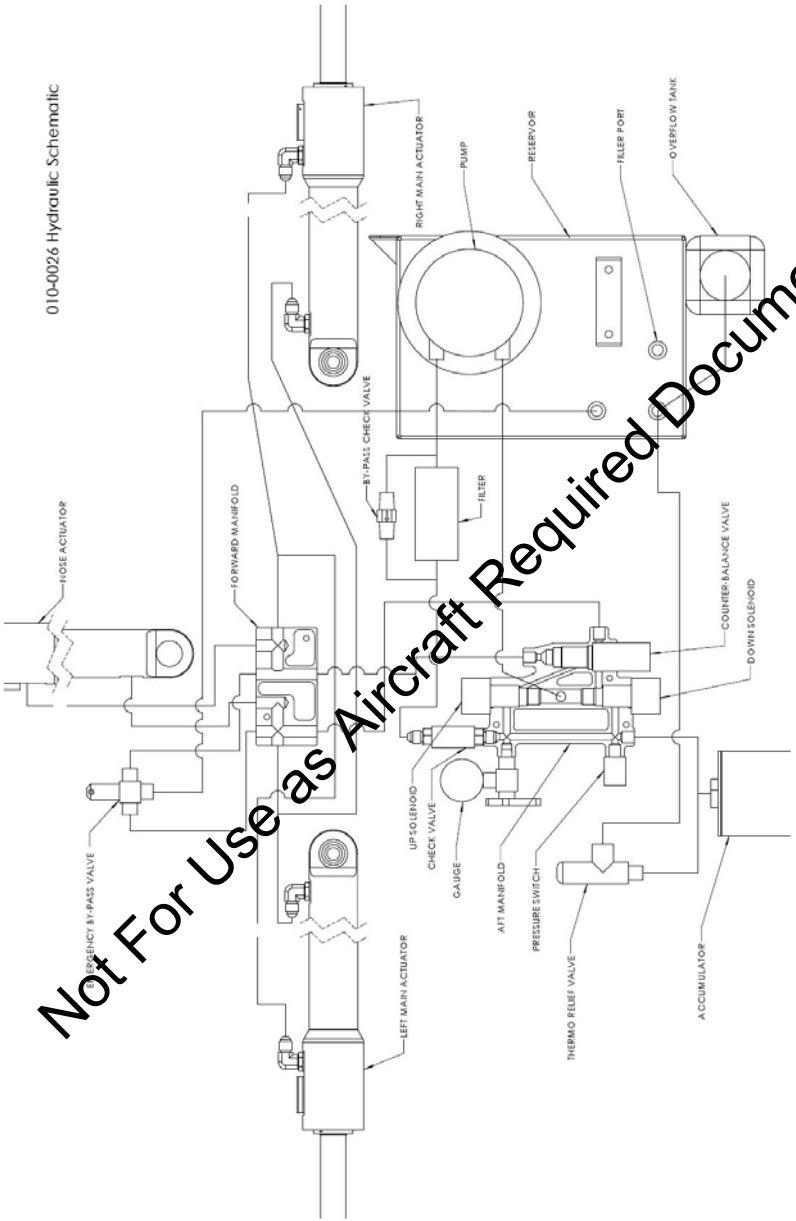
CAUTION

After flight when parking and securing the aircraft ensure the fuel selector is either in the left or right tank position. If the selector is "in between" the fuel in the higher wing will drain to the lower wing causing a dangerous imbalance condition. Also, fuel may dump through the vent system onto the ramp until the higher wing is completely empty.

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 2000 psi is provided to the up side of the landing gear actuators raising the gear. This pressure is maintained although the electric pump is disabled by a limit pressure switch and the pressure holds the gear in its retracted position. Upon selecting the "down" position, 2000 psi is provided to the down side of the actuators and lowers the landing gear until it is down and locked.

As with any hydraulic system proper servicing is required. Use only MIL-L-5606 "red" hydraulic fluid.



Schematic of the Hydraulic System

BRAKE SYSTEM

The aircraft brake system is installed on both the pilot's and co-pilot's sides of the aircraft. Steering of the aircraft on the ground is by use of differential brakes. The rudder pedals incorporate independent toe-brake cylinders operating the "Cleveland" type disk brakes on the main gear. 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 aircraft's basic electrical system consists of a generator, a voltage regulator and two batteries. The generator provides power to the main electrical bus and the batteries. From the main bus, power is supplied to the entire aircraft. For a detailed schematic of the electrical and avionics system, refer to the provided avionics manual.

Since the aircraft is a composite design, all circuits require the use of a return wire leading to "ground". The use of a ground bus 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 the MCU.

PITOT PRESSURE SYSTEM

The aircraft should be fitted with a standard heated pitot probe typically located on the lower outboard 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 pitot 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 is clear and that any cover has been removed.

WARNING

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

STATIC PORT LOCATION

The static ports are in the fuselage at the following locations:

- Left Side Port: 12-1/4” +/- above the baggage floor and 15” +/- forward of the pressure bulkhead.
- Right Side Port: 1-1/2” +/- above the door edge and 15” +/- forward of the pressure bulkhead (just behind the top rear door latch anchor).

If the aircraft has been outdoors for some time the preflight should check for cleanliness. The ports should be flush, round and square with the fuselage and be sharp-edged holes. If 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.

PRESSURIZATION

Your aircraft has been designed and tested to provide you with a reliable and simple to operate system. It will require you to have a complete understanding of its operation and follow a few simple procedures to ensure the safety and comfort of you and your passengers.

ENVIRONMENTAL SYSTEMS DESCRIPTIONS

Cabin altitude, differential pressure, and air conditioning are controlled and displayed on a Radiant (Moritz) Aerospace A2120 flat panel display.

Environmental Control System - The environmental system consists of a bleed-air system, cabin air distribution system, pressurization and control system, and a ventilating air system.

The bleed air system provides the air supply for pressurizing the cabin. The temperature of the bleed air is controlled using a flow pack exchanger which utilizes ambient air to cool the bleed air.

Pressurization System - The pressurization system consists of an outflow valve, pressurization control through the Radiant (Moritz) A2120, electro-pneumatic operated vacuum solenoid valve, dump switch, inflatable door seals, safety valves, and associated interconnecting plumbing and wiring. The pressurization system controls pressure in the cabin to a maximum of 6.5 psi. This is done by regulating the exit of the air through the outflow valve located in the pressure bulkhead at the rear of the aircraft.

Safeguards in the system include two automatic over-pressure valves and a manual emergency dump switch. Additionally, an electrical circuit will not allow power to operate the system until the gear is up and over 69 kts airspeed has been attained.

The inflatable door seals create an air-tight seal between the aircraft doors and the fuselage. To inflate the seals, ensure the doors are latched then activate the door-seal pumps using the overhead door pressurization switch. To deflate the seals prior to

opening the doors or for non-pressurized flight turn the door pressurization switch to the OFF position. A manual door seal pressure release switch is located on each door should electrical power be unavailable for normal operation.

RADIANT (MORITZ) AEROSPACE, A2120 FLAT PANEL DISPLAY

GENERAL

The Flat Panel Display allows for the user interface and control of the electronic circuit breakers as well as the onboard HVAC and pressurization system. The Flat Panel communicates with the Radiant (Moritz) DC Box (A2240) and the Radiant (Moritz) Climate Control Unit (A2245) via dual CAN bus interfaces.

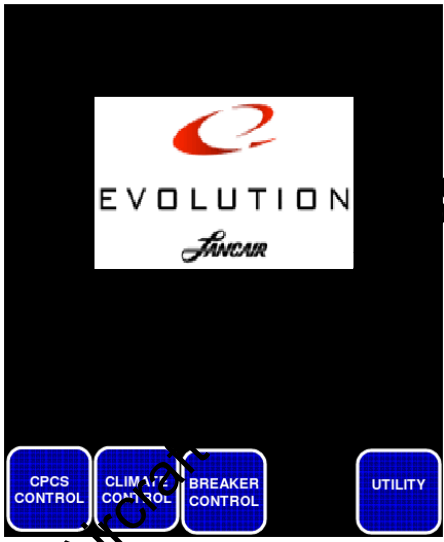
A RS-232 interface is used for communication with the cabin pressurization outflow valve.

A touch screen interface is provided on the Flat Panel Display. The touch screen has a circular polarization filter built in to reduce glare during high ambient light situations.

OPERATION

The Flat Panel Display is configured to provide multiple pages of information and controls for the user. Each page is outlined in the following sections.

MAIN PAGE



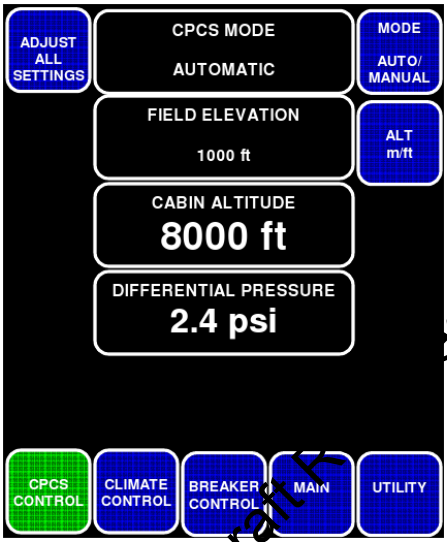
This is the page that is displayed after power up. Pressing any one of the buttons across the bottom of the page will take you to that page. Each button will have a blue background, white text and a white border.

The "Breaker Control" button maps to pages where electronic circuit breakers are controlled. In the event of a breaker trip, the button background will change from blue to red indicating a tripped breaker on that page. Pressing the red button will take you to that page where the tripped breaker is indicated in red.

The "CPCS" (Cockpit Pressure Control System) button maps to pages where the cockpit pressure control system is configured. In the event of cabin pressure that exceeds 12,000 ft. or differential pressure that exceeds 6.7 psi, the button background will change from blue to red indicating an error has occurred. The A2120 will

also annunciate an audible alarm if either of these conditions occurs. Pressing the red button will take you to the CPCS page where the pressure error data is indicated in red.

CPCS CONTROL PAGE, AUTOMATIC/MANUAL



Automatic Mode Display

The CPCS page, when selected, is indicated by the "CPCS Control" button having a green background, white border and white text. If cabin pressure is above 12,000 ft. or differential pressure is above 6.7 psi, the button will have a red background and the alarm output of the flat panel is enabled.

Field Elevation (Automatic mode) - Displays Field Elevation setting (accessed via "Adjust "settings" button). It has a black background, white text, and white border.

Cabin Altitude - Displays actual cabin pressure in ft. It has a yellow background if cabin altitude exceeds 10,000 ft.

If cabin altitude exceeds 12,000 ft., the background will go red, an audible alarm will sound, and the CPCS CONTROL button will have a red background on every page.

If communication is lost with the pressure control system, COMM ERROR is displayed in this window, but no audible alarm is sounded.

Differential Pressure - Displays differential pressure between actual cabin pressure and altitude pressure. When differential pressure exceeds 6.7 psi, the Differential Pressure window will have a red background, an audible alarm is sounded, and CPCS CONTROL button will have a red background on every page.

If communication is lost with the flight control system (absolute altitude), COMM ERROR is displayed in this window, but no audible alarm is sounded.

ALT m/ft - Pressing this button changes the units of displayed numbers between feet and meters. It has a blue background, white text, and white border.

Mode Auto/Manual - Pressing this button selects manual or automatic CPCS operation. It has a blue background, white text, and white border. The selected mode is indicated in the center of the display with a black background, white text, and white border.

When Manual Mode is selected, the border changes to yellow.

Automatic mode will display Field Elevation, Cabin Pressure, and Differential Pressure. All will use white text, black background and a white border.

Cabin Pressure will display a yellow background if over 10,000 ft., and a red background over 12,000 ft. If over 12,000 ft., an audible alarm will sound and the CPCS CONTROL button on each page will go red.

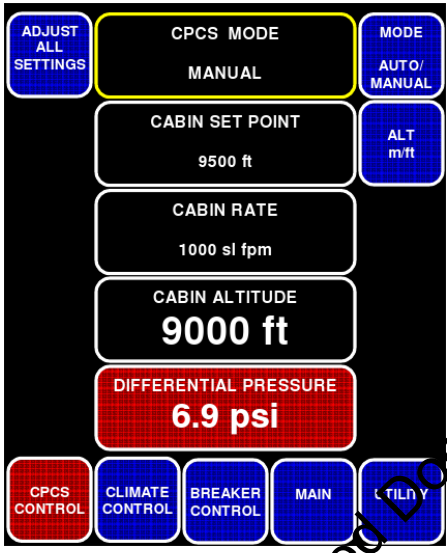
If communication is lost with the pressurization system, the Cabin Altitude will indicate "COMM ERROR" in red text and the CPCS control button background will change to red. There will be no audible alarm for this condition.

Differential Pressure will have a red background if over 6.7 psi. An audible alarm is sounded and the CPCS CONTROL button on each page will go red.

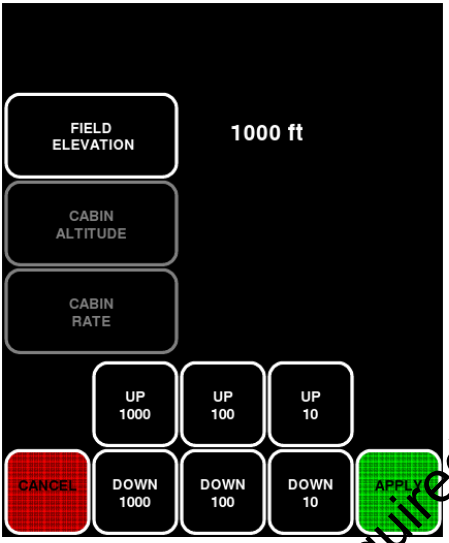
Automatic mode numbers displayed are configured on the "Adjust Settings" page.

Manual mode will display Cabin Set Point, Cabin Rate, Cabin Altitude, and Differential Pressure. All will use white text, a black background and a white border. Manual mode numbers displayed are configured on the "Adjust Settings" page.

Adjust Settings - Pressing this button takes you to the "CPCS Configuration" page. It has a blue background, white border, and white text.



Manual Mode Display



Automatic Mode Settings

The CPCS configuration page is reached by pressing the “Adjust Settings” button on the CPCS Control page. Depending on the CPCS Mode selected prior to entering the configuration page, the appropriate settings available for adjustment are in white on a black background. The non-adjustable settings will be “grayed” out.

Field Elevation (Automatic Mode only) – This button has a black background, white text, and white border.

Press to select “Field Elevation” for adjustment. It has a black background, white text, and yellow border when selected. The yellow outline indicates that this is the setting being adjusted.

Selecting “Field Elevation” enables adjustment of the Field Elevation setting displayed to the immediate right of button. It is adjusted via up down buttons at the bottom of the screen.

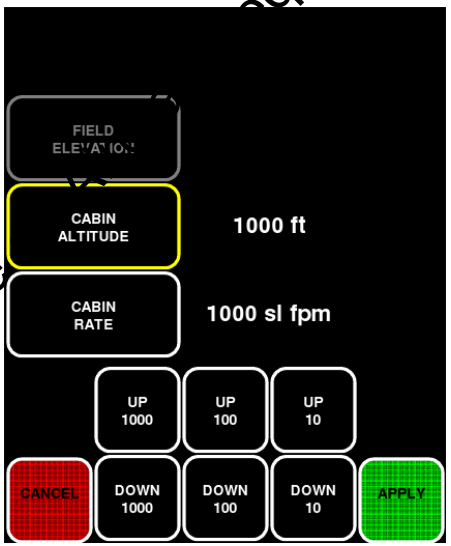
Maximum setting: 10000 ft.

Minimum setting: -1000 ft.
Increment: 10 ft.

Settings for Cruise and Field elevation are sent to the CCU when the “Apply” button is pressed.

Cancel – This button has a red background, white text, white border. Press to return to the CPCS control page WITHOUT saving settings or sending information to the CCU.

Apply (automatic mode) – This button has a green background, white text, white border. When pressed, it returns the user to the CPCS control page and sends the value for Field Elevation (ARINC label 127) to the CCU, which then formats the received data for transmission via ARINC to the Dukes CPCS unit. The set values are also transferred to the CPCS control page for display.



Manual Mode Settings

Cabin Altitude (Manual Mode only) – This button has a black background, white text, and white border. Press to select “Cabin Altitude” for adjustment. It has a black background, white text, yellow border when selected. The yellow outline indicates that this

is the setting being adjusted. The yellow outline changes back to white when Cabin Rate is selected. Selecting “Cabin Altitude” enables adjustment of the Cabin Altitude setting displayed to the immediate right of button. It is adjusted via up down buttons at the bottom of the screen.

Maximum setting: 12,000 ft.
Minimum setting: Field Elevation Setting (ft)
Increment: 100 ft.

Settings for both Cabin Altitude and Cabin Rate are sent to the CCU only when the “APPLY” button is pressed.

Cabin Rate (Manual Mode only) – It has a black background, white text, white border. Press to select “Cabin Rate” for adjustment. It has a black background, white text, yellow border when selected. The yellow outline indicates that this is the setting being adjusted. The yellow outline changes back to white when Cabin Altitude is selected. Selecting “Cabin Rate” enables adjustment of the Cabin Rate setting displayed to the immediate right of button. It is adjusted via up down buttons at the bottom of the screen.

Maximum setting: 4000 sl fpm (sea level feet per minute)
Minimum setting: 250 sl fpm
Increment: 100 sl fpm

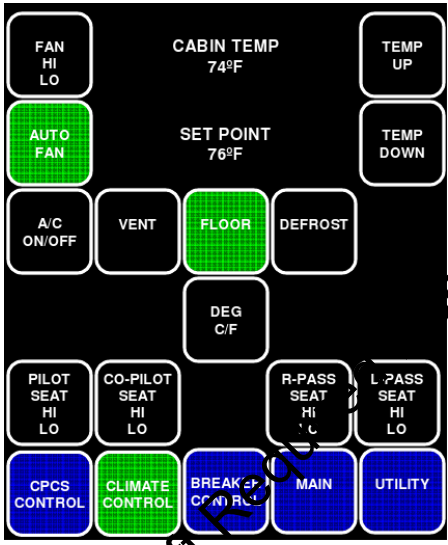
Settings for both Cabin Altitude and Cabin Rate are sent to the CCU only when the “APPLY” button is pressed.

Cancel – It has a blue background, white text, and white border. Press to return to the CPCS control page WITHOUT saving settings or sending information to the CCU.

Apply (Manual mode) – It has a blue background, white text, white border. When pressed returns the user to the CPCS control page and sends the values for Cabin Altitude (ARINC label 171) and Cabin Rate (ARINC label 171) to the CCU, which then formats the received data for transmission via ARINC to the Dukes

CPCS unit. The set values are also transferred to the CPCS control page for display.

HVAC PAGE



HVAC Control Display

The HVAC Control page, when selected, is indicated by the "Climate Control" button having a green background, white border, and white text.

Fan Hi, Lo, Off Button - This button is used to turn the fan on LO, HI or OFF. It has a black background, white text, with white border, when OFF. When pressed ON, it has a green background, white text and white border when LO or HI. Pressing this button sends a corresponding message to the CCU. When first pressed, the Fan will toggle Lo. When next pressed, the Fan will toggle Hi. When pressed again, the Fan will toggle Off and the background will return to black.

When the air conditioning is turned on, the fan is turned on and its speed is determined by the delta between the cabin temperature and the set point. This determination is be made in the CCU and a message is be sent to the flat panel to indicate the proper button to

illuminate. Any fan speed may be manually selected when the air conditioning is on, but the fan may not be turned off.

Auto Fan Button - This button is used to turn the fan on with automatic control. It has a black background, white text, with white border, when OFF. When pressed ON, it has a green background, white text and white border. Pressing sends a corresponding message to the CCU and the DC Box ECB controlling the fan. When the Auto Fan is turned on, the fan is turned on and its speed is determined by the delta between the cabin temperature and the set point. This determination is made in the CCU and a message is sent to the flat panel to indicate the proper button to illuminate.

A/C ON/OFF Button - This button controls the Air Conditioning on and off. It has a black background, white text with white border, when OFF. It has a green background, white text, and white border when ON. The button is mapped to an ECB in the DC Box that controls the AC compressor on and off. An AC ON/OFF message is also sent to the CCU. The CCU uses this information to control the fan speed while the AC is on. When the air conditioning is turned on, the fan is turned on and its speed is determined by the delta between the cabin temperature and the set point. This determination is made in the CCU and a message is sent to the flat panel to indicate the proper button to illuminate. Any fan speed may be manually selected when the air conditioning is on, but the fan may not be turned off. When the AC is turned off, the fan will continue to run at the speed it was last set to. The fan can then be manually turned off. This button is also the indicator for the ECB status. The button has a red background, white text, and white border if the circuit breaker has tripped.

Deg C/F Button – This button is used to select temperature display in either Fahrenheit or Centigrade. When pressed, the display temperature units toggle between Fahrenheit or Centigrade. The default is Fahrenheit at power up.

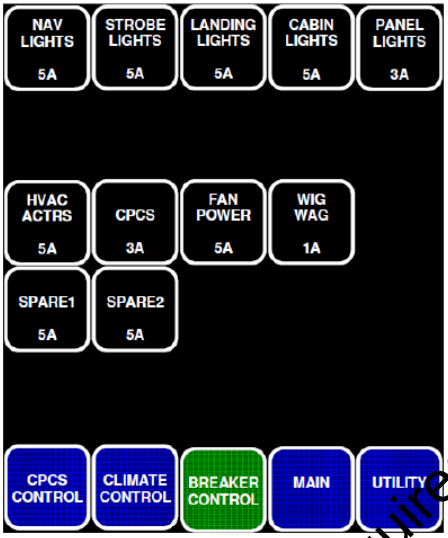
Temp Up/Down Buttons – This button is used to set select the desired cabin temperature. It has a black background, white text, and white border. Setpoint Temperature increases when Temp Up is pressed. A message is sent to the CCU when Temp Up is pressed. Setpoint Temperature decreases when Temp down is pressed. A message is sent to the CCU when Temp Down is pressed.

Vent, Floor, Defrost Buttons – These buttons are used to select air outlet port. They have a black background, white text, and white border when the port is closed and a green background, white text, and white border when the port is open. It is mapped to individual servo control circuits in the CCU. When selected, an "open" message is sent to the CCU. When deselected, a "close" message is sent to the CCU. The default port is "Floor" at power up.

NOTE
A minimum of one port must be open at all times.

Pilot, Co-pilot, R-Pass, & L-Pass Seat Hi/Lo/Off Buttons – These buttons are used to control the seat heaters for the Pilot, Co-Pilot, R-Pass, and L-Pass. They have a black background, white text, and white border while the seat heater is off. They have a green background, white text, and white border when the seat heater is on. They are mapped to individual ECBs in the DC Box. These buttons are also the indicator for the ECB status. The button has a red background, white text, and white border if the circuit breaker has tripped. When first pressed, the seat heater will toggle Lo. When next pressed, the seat heater will toggle Hi. When pressed again, the seat heater will toggle Off, and the background will return to black. With each selection, a message is sent to the DC Box. All seat heaters default to Off at power up.

BREAKER CONTROL PAGE



Breaker Control Display

Nav, Strobe, Landing Lights, Panel Lights Buttons – These buttons are used to enable or disable Navigation, Strobe, Landing Lights or Panel Lights. They have a black background, white text, and white border when lights are off. They have a green background, white text, and white border when lights are on. They have a red background, white text, and white border if the circuit breaker has tripped. They are mapped to individual ECB circuits in the DC Box. With each selection, a message is sent to the DC Box.

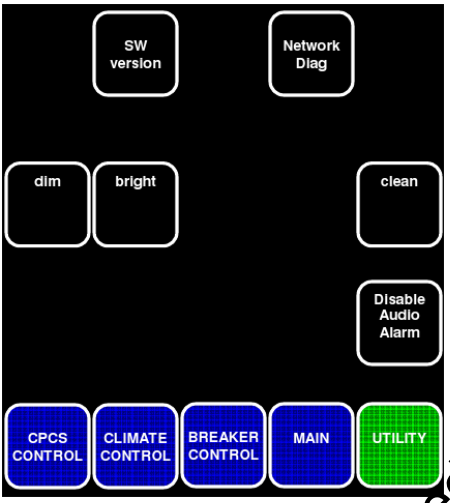
HVAC Actuators – This button is used to enable or disable the power to the HVAC vent and mix actuators. It has a black background, white text, and white border when HVAC power is off and a green background, white text, and white border when HVAC power is on. It has a red background, white text, and white border if circuit breaker has tripped. This button is mapped to an individual ECB circuit in the DC Box. With each selection, a message is sent to the DC Box.

CPCS Breaker – This button is used to enable or disable the power to the Cabin Pressure Control System. It has a black background, white text, and white border when CPCS power is off and a green background, white text, and white border when CPCS power is on. The button has a red background, white text, and white border if the circuit breaker has tripped. It is mapped to an individual ECB circuit in the DC Box. With each selection, a message is sent to the DC Box.

Fan Power – This button is used to enable or disable the power to the Fan control relays. It has a black background, white text, and white border when Fan power is off and a green background, white text, and white border when Fan power is on. This button has a red background, white text, and white border if the circuit breaker has tripped. It is mapped to an individual ECB circuit in the DC Box and defaults to "ON". With each selection, a message is sent to the DC Box.

Spares – These buttons are used to enable or disable the power to the spare ECB. All Spares are currently set for 5A. The buttons have a black background, white text, and white border when Spare power is off and a green background, white text, and white border when Spare power is on. The buttons have a red background, white text, and white border if the circuit breaker has tripped. They are mapped to an individual ECB circuit in the DC Box. With each selection, a message is sent to the DC Box.

UTILITY PAGE



Network Diag Button – This button causes the Flat Panel Touch screen to perform CAN network diagnostics. It has a black background, white text, and white border when Diagnostic function is Off and a green background, white text, and white border when the diagnostic function is On.

Dim Button – This button causes the Flat Panel Touch screen to diminish visual intensity.

Bright Button – This button causes the Flat Panel Touch screen to increase visual intensity. Bright is the default flat panel setting when powered on.

Clean Button – This button causes the Flat Panel Touch screen to ignore screen entry for 10 seconds to allow cleaning of the Flat Panel Screen.

Disable Audio Alarm – This button causes the Flat Panel to disable an active audio alarm. This button has no effect unless there is an active alarm sounding.

SW Version – This button causes the Flat Panel Touch screen to display the current software version.

REGULATIONS

FAR 61.31 (f) "High altitude airplanes, (1) Except as provided in paragraph (f)(2) of this section, no person may act as pilot in command of a pressurized airplane that has a service ceiling or maximum operating altitude, whichever is lower above 25,000 feet MSL unless that person has completed the ground and flight training specified in paragraphs (f)(1), (i) and (ii) of this section and has received a logbook or training record endorsement from an authorized instructor certifying satisfactory completion of the training."

Since the aircraft's recommended service ceiling is 28,000 ft. (FL280), it falls within the requirements of Far 61.31 (f) above. Read literally, it says that once the aircraft is classified as "pressurized" the PIC must have the training even to fly the aircraft around the patch. FAR 91.211 details the oxygen requirements for flight at and above 12,500 feet for any aircraft, and for pressurized aircraft above Flight Level 250. In the short version, we need supplemental oxygen from 12,500' to 14,000', if we stay there more than 30 minutes. If we go higher than 14,000' for any length of time, oxygen is required. And of course we must provide passengers with supplemental oxygen above 15,000'. If the aircraft is pressurized and operates above FL250 then a further requirement, of at least 10 minutes supplemental oxygen per person, is imposed to give the aircraft sufficient time to descend below 12,500' in case of loss of cabin pressurization. A study of the following section emphasizes the need for supplemental oxygen.

ALTITUDE REACTION – IN FEET

5,000’ – Use of supplemental oxygen at and above 5,000 feet for night flying will benefit the pilot, particularly towards the end of flight. Smoking reduces visual acuity and service altitude of the individual.

8,000’ – Over prolonged flights, there are measurable changes in blood pressure and respiration. Mild hypoxia can result. It is generally assumed that the normal, healthy individual is unlikely to need supplementary oxygen at, and below, this altitude.

10,000’ – Fatigue, drowsiness and sharp headaches can occur with increasing quickness if flights are made without supplemental oxygen at this and higher altitudes.

18,000’ – This is the halfway point in the earth’s atmosphere and pressure is reduced to 7.32 psi and oxygen saturation in the body is only 75%. Without supplemental oxygen, hypoxia is almost immediately apparent and efficiency deteriorates quickly and drastically. Unconsciousness can occur if supplemental oxygen is not used.

20,000’ – Unconsciousness can occur in as little as 5-7 minutes without supplemental oxygen.

25,000’ – Hypoxia rate increases rapidly, usually less than five minutes of consciousness without supplemental oxygen.

28,000’ – Immediate 100% loss of coordination without supplemental oxygen.

30,000’ – Unconsciousness in two (2) minutes without supplemental oxygen.

HANDLING, SERVICING, & MAINTENANCE

Section VII
Table of Contents

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INTRODUCTION TO SERVICING

This section is designed to help you the owner and pilot of your Lancair to service and maintain it in a safe and efficient manner. The information is approved by Lancair International. The intended user of this handbook is the pilot, not the aircraft's mechanic. The information 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 should be used as a guide.

GROUND HANDLING

The three view drawings in Section I show the dimensions of your airplane and its hangar requirements.

CAUTION

Proper inflation of the air/oleo style nose strut should be maintained to insure adequate propeller clearance.). In addition, while ground handling your Lancair, the propeller should be placed in the horizontal position, or with one blade up on a 4- blade prop.

TOWING

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 rear fuselage forward of 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.

JACKING

MAIN WHEEL JACKING

The aircraft can have one wheel raised by jacking. A hydraulic jack is recommended. 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 by securing some weight about the aft fuselage or using the tail tie-down (screw in type only). An alternate method is to remove the top cowl and attach a hoist to the engine lifting ring, then raise the nose as desired (watch the spinner). 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 it in your garage where you have (or can provide) some control over temperature and humidity. 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 inlet) covered or plugged and the battery removed.

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.
- 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 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.

FUEL TANK CAPACITY

All fuel is carried in the wing's integral tanks. Fuel tank caps are located on the upper wing surface near the wing tips.

Fuel Capacity = 168 U. S. Gallons.

WARNING

When fueling, ensure that the aircraft is grounded at the nose gear tow bar bracket to eliminate static electrical discharges.

APPROVED FUELS

Refer to the latest revision of Pratt & Whitney Service Bulletin No. 1244 for approved fuels and additives.

Use of Fuel anti-icing additives (Prist) is approved.

OIL SYSTEM SERVICING

APPROVED OILS

Refer to the latest revision of Pratt & Whitney Service Bulletin No. 1001 for approved oils.

OIL LEVEL CHECK

To avoid overfilling the tank and consuming excess oil, an oil level check is recommended within 30 minutes after engine shutdown. The ideal interval is 15 to 30 minutes. If more than 30 minutes has passed, and the dipstick indicates that oil is needed, start the engine and run at ground-idle for five minutes, and recheck the oil level as follows:

1. Unlock the filler cap and dipstick from the filler neck on the accessory gear box and remove the filler cap.
2. Wipe the dipstick with a clean lint free cloth.

CAUTION

When the filler cap and dipstick/gauge assembly is installed and locked, no movement is allowed.

3. Install the cap/dipstick and lock.

4. Remove the cap/dipstick.
5. Check the oil tank contents against the markings on the dipstick (markings correspond to U. S. quarts) and service as required.

   Note 1: Graduations on the dipstick indicate oil level in U. S. quarts below the maximum capacity of the oil tank. Normal cold oil level is the MAX COLD mark on the dipstick. Normal hot oil level is the MAX HOT mark on the dipstick. A dipstick reading of 3 will indicate the system requires two U. S. quarts to replenish to normal level if the oil is cold and three U. S. quarts if the oil is hot.

   Note 2: If the engine is nose high or nose low, compensation must be made to avoid over or under servicing.

   Note 3: Filling the oil to the maximum level may result in a high consumption rate, with the oil exiting through the AGB breather. On some engines, this may also occur with the oil level at one or two U. S. quarts below the maximum level. In such cases, operators are advised to service the oil to the level that results in acceptable consumption, down to 3 quarts below the maximum, if necessary. This practice is acceptable due to the large usable oil quantity, and providing the oil level is monitored using the engine maintenance manual, making sure the consumption allowance and operation are within the recommended oil temperature and pressure.

6. If the oil level is too low to register on the dipstick due to possible excessive consumption, or if low or fluctuating pressures have been recorded, refer to Fault Isolation Engine Lubrication for action to be taken, then proceed as follows:

a. Fill the oil tank to normal level and record the quantity of oil added.
b. Install the filler cap/dipstick making sure the cap is locked.

CAUTION

When the filler cap assembly is installed and locked, no movement is allowed.

c. Run the engine at ground-idle for approximately five minutes.
d. Check the oil level (Steps 1 through 6.)

OIL CHANGES

Refer to the latest revision of the Pratt & Whitney Maintenance Manual for oil change service intervals.

HYDRAULIC SYSTEM SERVICING

SYSTEM SERVICING

The hydraulic system operates at 2000 psi with a thermal relief valve opening at 2500 psi to prevent an overpressure. The accumulator pressure is 1000 to 1100 psi and is serviced with nitrogen. Hydraulic fluid must conform to the latest revision of Mil-Spec-5606. The hydraulic reservoir is contained in the pump body which is located beneath the baggage compartment floor. Hydraulic fluid servicing can be accomplished as follows:

1. Remove the left rear seat by lifting the two pins on either front side of the seat at the floor. Then slide the seat aft out of the dovetail blocks that fasten it to the floor.
2. Remove the baggage compartment carpet.
3. Remove the baggage compartment floor panel running longitudinally on the left side of the baggage compartment to reveal the pump body beneath the front end of the panel.
4. Remove the plug in the tip of the pump body and visually inspect the fluid level.

5. With the gear down and the accumulator full, the hydraulic oil should be 1-1/2 inch below the top of the fill port boss or 1 inch below the top of the flat surface of the reservoir.

ACCUMULATOR SERVICING

1. Discharge the hydraulic pressure as follows:
    a. With the gear switch in the down position and the system on, pull the hydraulic pump breaker.
    b. Open the emergency by-pass valve.
    c. Verify the hydraulic manifold gauge now reads zero pressure.
2. The gas pressure, with zero hydraulic pressure, should read between 1000 psi and 1100 psi.
3. Use the method that prevents gas leakage during measurement such as a strut service valve.
4. Add gas to attain this pressure as needed.

TIRES

The aircraft tires should be properly inflated at all times. 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 and cuts. The tread should be > 1/16".

WARNING

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

MAIN GEAR

The main gear tires are size 18 x 4.4, six ply, 160 mph Michelin (part no. 021-611-0). Inflate with nitrogen to 80 to 100 psi (85 psi recommended.

NOSE GEAR

The nose gear tire is size 5 x 5, six ply, Michelin (part no. TRMA-5.00x5-6). Inflate with nitrogen to 45 to 55 psi.

NOSE GEAR SHOCK STRUT

Nose wheel struts contain pressurized air 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 nose wheel. It should 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 bearings are properly snug. There must be no free play between bearings and race. Check that the side bushings are properly snugged 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.

MAIN GEAR STRUT

The main gear struts should be pressurized with nitrogen to 250 psi with the aircraft jacked.

NOSE GEAR STRUT

The nose gear is a free castering oleo strut that rotates 50° to either side. It is serviced with dry nitrogen and oil and should be pressurized so that 3.25” to 4.5” of strut are showing.

BRAKES

The aircraft is equipped with Cleveland 30-280 hydraulic brakes. The brakes are independent systems on each of the main gear wheels. The fluid reservoir for each is located on the top left side of the firewall. The toe brakes should depress approximately ½ 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 inch thick. The brake pucks should be replaced when less than this value.

PROPELLER

Your propeller should be serviced according to the manufacturer's instructions. It is highly stressed component and any failure has the potential of being catastrophic. Treat it with care. For aluminum blade propellers, 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.

BATTERY

The aircraft is equipped with two sealed lead-acid Concord batteries (part no. RG-24-20). These should be visually inspected during the Condition Inspection for condition and leakage and the terminals cleaned and sealed.

CONTROL LOCKS

The normal procedure for locking the control surfaces is to use the seat belt strapped over the side stick controller and snugged firmly to prevent control surface movement.

A supplemental control restraint strap is available from Lancair that greatly simplifies securing the controls.

TIE-DOWN

Tie-down is accomplished using metal eyebolt lugs which screw into receptacles in the bottom surfaces of the wing and beneath the tail.

AIRCRAFT JACKING

If jacking of the aircraft is required, use three tripod jacks positioned properly and using the following procedure:

Precautions

1. Ensure the jack has the proper lifting capacity and is serviceable.
2. Select a hard, level surface.
3. Ensure the CG and gross weight are within safety limits.
4. Ensure clear communications between the maintenance personnel.
5. Ensure the area around the aircraft is clear of equipment and tools.

Procedure

1. Remove the chocks from the wheels.
2. Use approved jacking hardware.
3. Place all jacks at the specified jacking points.
4. Jacking points are located 84" aft of the firewall in the wing fillets and 240.5" aft of the firewall under the stern post.
5. Spot one person at each jacking point, ensuring that the jacks are properly placed.
6. Raise the jack slowly until the jacking pad is just shy of the jacking point and align it.
7. Slightly raise the nose wheel first then simultaneously raise all the jacks until the wheels clear the surface by one inch.
8. Engage the jack locking mechanism to prevent settling due to hydraulic leakage in the jack.
9. Place signage "A/C ON JACKS" in front of the aircraft.
10. Perform the required maintenance of the aircraft.
11. Before lowering the aircraft, ensure the parking brakes are OFF and the area below the wheels is clear of objects.

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, benzene, 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 usual 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 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 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 cloths and minimizes rubbing to avoid damage to the paint film surface. Rinse thoroughly with clean 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, pitot probes and static ports. Cover cooling air ports to the interior and avionics.

ENGINE

Clean the engine with a neutral solvent. While the engine is warm but not hot, spray it with solvent and allow the solvent to sit for a few minutes. Follow with a spray wash and allow the engine 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 through 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.

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RECOMMENDED SERVICING

Interval – Preflight

- ☐ Check & service engine oil
- ☐ Drain water trap
- ☐ Verify fuel quantity

Interval – First 25 Hours

- ☐ Service oil. Inspect for rub and wear inside cowling
- ☐ Inspect fuel lines for security
- ☐ Check bleed air lines for security
- ☐ Check battery fluid
- ☐ Check brake lines
- ☐ Check all gear doors (nose and main gears)
- ☐ Check control surface hinges and control rods and connections
- ☐ Jack the aircraft and retract gear/check gear door fit

Interval – Each 50 Hours

- [ ] Lube landing gear mechanisms
- [ ] Check control surface hinges and all control rods and connections
- [ ] Check brake lines
- [ ] Check all gear doors (nose and main gears)
- [ ] Check control surface hinges

Interval – Each 100 Hours

- [ ] Clean fuel strainers
- [ ] Hoses, wear, tightness, no cracks
- [ ] Check cowling attach fasteners
- [ ] Check attach points and wing bolts
- [ ] Clean/change engine fuel filter
- [ ] Check engine mounts
- [ ] Secure and no cracks in air plenum

- [ ] Exhaust stacks – check for cracks, secure
- [ ] Inspect and dress the propeller
- [ ] Check rudder cables for condition and security
- [ ] Check/service gear and hydraulic reservoir
- [ ] Jack the aircraft and retract gear/check gear door fit
- [ ] Repack wheel bearings (all three)
- [ ] Check nose wheel and shimmy damper
- [ ] Check gear drag braces are secure
- [ ] Flex lines – check for chafing, especially in gear wells
- [ ] Check security/wear of flap actuator
- [ ] Check for rubbing/wear of flap to aircraft fit
- [ ] Check for rubbing/wear of aileron to flaps and wing fit
- [ ] Check battery electrolyte level and specific gravity
- [ ] Check operation of exterior lights and strobes
- [ ] Check operation of landing lights
- [ ] Check operation of cockpit lights
- [ ] Check operation of ELT/battery life

- [ ] Check functioning of static system and transponder for no leaks, tight
- [ ] Check and secure door attach points and mechanism
- [ ] Check door actuation mechanism and hinge pins for wear and lube
- [ ] Check shoulder harness attach points for security. Check for fraying material
- [ ] Check seat belts attach points for security. Check for fraying material
- [ ] Check airframe for delamination, cracks, chipped paint, etc.
- [ ] Check airframe for debonding of layups/seams/junctions

SUPPLEMENTS

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WEIGHT AND BALANCE WORKSHEET

Evolution N#____ S/N____ Date____	
Empty Weight CG	
CG Range 121.9 to 129.6	Max Gross Weight 4300 lbs
MAC = 10% to 28%	Note: 121.03 = 8% MAC
Datum = 78 inches forward of the firewall	

	Weight	**Moment Arm**	**Moment Weight**	**Station**	
Nose Gear					
Left Main					
Right Main					
Empty CG					**Empty CG**
Aircraft					
Pilot					
Fuel					
Ballast					**CG**
+ copilot					
+ pass. 3					
+ pass. 4					
Baggage					
GWT					**Loaded CG**

Empty weight includes: operating fluids (oil, hydraulic), unusable fuel, interior panels, seats, upholstery, etc.

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SAMPLE LOADING WORKSHEET

Evolution N#____ S/N____ Date____					
Empty Weight CG					
CG Range 121.9 to 129.6		Max Gross Weight 4300 lbs			
MAC = 10% to 28%		Note: 121.03 = 8% MAC			
Datum = 78 inches forward of the firewall					
	Weight	**Moment Arm**	**Moment Weight**	**Station**	
Nose Gear	508	61.75	31369		
Left Main	935	139.25	130198.75		
Right Main	919	139.25	127970.75		
Empty CG	2362		289538.5	**122.58**	**Empty CG**
Aircraft	2362		289538.5		
Pilot	180	128	23040		
Fuel	544	136.375	74188		
Ballast		0	0	**125.33**	**CG**
+ copilot		128	0		
+ pass. 3		164	0		
+ pass. 4		164	0		
Baggage	130	192	24960		
GWT	**3216**		411726.5	**128.02**	**Loaded CG**

Empty weight includes: operating fluids (oil, hydraulic), unusable fuel, interior, panels, seats, upholstery, etc.

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Recommended Aircraft Equipment Requirements
By Types of Flight Operations

Flight Operation Definitions:

All – Required for all flight operations
Night – Required for night flight operations
Optional – Not required for flight operations

Bullets in the Flight Operations Requirements columns indicate the requirement for that item.

Instrumentation Item	All	Night	IFR	Optional
Garmin GDU 1045 PFD	•			
Garmin GDU 1045 MFD	•			
Garmin GCU 476 Keypad				•
Garmin GRS 77 AHRS	•			
Garmin GDC 74A air data computer	•			
Garmin GMU 44 Magnetometer	•			
GMA1347 Audio panel				
Standby Attitude Indication			•	
Standby Altitude Indicator			•	
Standby Airspeed Indicator			•	
Outside Temperature Indication	•			
Magnetic Compass	•			
Clock			•	
Trim Position Indicator	•			
Landing Gear Position Warning	•			
Hydraulic Pump Operation	•			
Stall Warning	•			
Engine Torque	•			
Engine ITT	•			
Gas Gen RPM (Ng)	•			
Prop RPM (Np)	•			
Engine Oil Pressure	•			
Engine Oil Temp	•			

Recommended Aircraft Equipment Requirements
By Types of Flight Operations

Flight Operation Definitions:

All – Required for all flight operations
Night – Required for night flight operations
Optional – Not required for flight operations

Bullets in the Flight Operations Requirements columns indicate the requirement for that item.

Instrumentation Item, Cont'd	All	Night	IFR	Optional
Fuel Quantity (2)	•			
Fuel Pressure	•			
DC Amperage	•			
DC Battery Volts (2)	•			
Landing Gear Position	•			
Stall Warning	•			
AoA Indicator				•

Recommended Aircraft Equipment Requirements By Types of Flight Operations

Flight Operation Definitions:

All – Required for all flight operations
Night – Required for night flight operations
Optional – Not required for flight operations

Bullets in the Flight Operations Requirements columns indicate the requirement for that item.

Aircraft System Item	All	Night	IFR	Optional
Firewall Fuel Shutoff	•			
Fuel Tank Selector	•			
Hydraulic Pump (Landing Gear Actuation)	•			
Electric Trim Actuation	•			
Electric Flap Actuation	•			
Pitot Heat			•	
All Position Lights		•		
Landing Lights		•		
Taxi Lights				•
Panel Instrument Lighting		•	•	
Cockpit Flood Lighting		•		

Recommended Aircraft Equipment Requirements
By Types of Flight Operations

Flight Operation Definitions:

All – Required for all flight operations
Night – Required for night flight operations
Optional – Not required for flight operations

Bullets in the Flight Operations Requirements columns indicate the requirement for that item.

Pressurization / HVAC System Item	**All**	**Night**	**IFR**	**Optional**
Pressurization Controller	•			
Cabin Outflow Valve	•			
Outflow Valve Relief Valve	•			
Cabin Altitude Indicator	•			
Cabin Pressure Differential Indicator	•			
Emergency Oxygen Supply	•			
Oxygen Masks (1 per occupant)	•			
Cabin Pressure> 10,000 ft. Altitude Amber Annunciator				
Cabin Pressure> 12,500 ft. Altitude Red Annunciator	•			
Operating Air Conditioning	•			
All, For Non-Pressurized Flights Below 12,500 ft. MSL				•

The following takeoff performance charts define the recommended settings for maximum engine life.

Maximum Takeoff Power at 1900 rpm and ISA-30

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	-15	2073	100
1000	-17	2073	100
2000	-19	2073	100
3000	-21	2073	100
4000	-23	2073	100
5000	-25	2073	100
6000	-27	2073	100
7000	-29	2073	100
8000	-31	2073	100
9000	-33	2073	100
10000	-35	2073	100
11000	-37	2073	100
12000	-39	2042	98

Maximum Takeoff Power at 1900 rpm and ISA-15

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	0	2073	100
1000	-2	2073	100
2000	-4	2073	100
3000	-6	2073	100
4000	-8	2073	100
5000	-10	2073	100
6000	-12	2073	100
7000	-14	2073	100
8000	-16	2073	100
9000	-18	2044	98
10000	-20	1989	96
11000	-22	1933	93
12000	-24	1879	90

Maximum Takeoff Power at 1900 rpm

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	15	2073	100
1000	13	2073	100
2000	11	2073	100
3000	9	2073	100
4000	7	2073	100
5000	5	2031	98
6000	3	1990	96
7000	1	1949	94
8000	-1	1904	92
9000	-3	1857	89
10000	-5	1810	87
11000	-7	1763	85
12000	-9	1716	83

Maximum Takeoff Power at 1900 rpm and ISA+15

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	30	1985	95
1000	28	1944	93
2000	26	1902	91
3000	24	1861	89
4000	22	1820	88
5000	20	1780	86
6000	18	1750	84
7000	16	1717	83
8000	14	1683	81
9000	12	1648	79
10000	10	1613	78
11000	8	1577	76
12000	6	1541	74

Maximum Takeoff Power at 1900 rpm and ISA+30

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	45	1667	80
1000	43	1638	79
2000	41	1609	77
3000	39	1580	76
4000	37	1551	75
5000	35	1520	73
6000	33	1499	72
7000	31	1477	71
8000	29	1453	70
9000	27	1429	69
10000	25	1403	67
11000	23	1377	66
12000	21	1351	65

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CLIMB PERFORMANCE CHARTS

The following climb performance charts define the recommended settings for maximum engine life.

Maximum Climb Power at 1900 rpm and ISA-30

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	-15	2073	100
2000	-19	2073	100
4000	-23	2073	100
6000	-27	2073	100
8000	-30	2073	100
10000	-35	2073	100
12000	-39	2012	97
14000	-43	1880	90
16000	-47	1740	83
18000	-51	1570	75
20000	-55	1435	69
22000	-59	1297	62
24000	-63	1180	57
26000	-67	1067	51
28000	-71	964	46
29000	-73	921	44

Maximum Climb Power at 1900 rpm and ISA-15

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	0	2073	100
2000	-4	2073	100
4000	-8	2073	100
6000	-12	2073	100
8000	-15	2073	100
10000	-20	1959	94
12000	-24	1846	89
14000	-28	1735	83
16000	-32	1630	78
18000	-36	1527	73
20000	-40	1430	69
22000	-44	1323	64
24000	-48	1203	58
26000	-52	1091	52
28000	-56	98	47
29000	-58	944	45

Maximum Climb Power at 1900 rpm and ISA

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	15	2073	100
2000	11	2073	100
4000	7	2073	100
6000	3	1977	95
8000	0	1886	91
10000	-5	1787	86
12000	-9	1686	81
14000	-13	1587	76
16000	-17	1491	72
18000	-21	1397	67
20000	-25	1310	63
22000	-29	1214	58
24000	-33	1132	54
26000	-37	1053	51
28000	-41	978	47
29000	-43	947	46

Maximum Climb Power at 1900 rpm and ISA+15

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	30	1997	96
2000	26	1922	92
4000	22	1828	88
6000	18	1734	83
8000	15	1660	80
10000	10	1583	76
12000	6	1505	72
14000	2	1428	69
16000	-2	1353	65
18000	-6	1275	61
20000	-10	1195	57
22000	-14	1108	53
24000	-18	1030	50
26000	-22	958	46
28000	-26	889	43
29000	-28	863	41

Maximum Climb Power at 1900 rpm and ISA+30

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	45	1683	81
2000	41	1637	79
4000	37	1565	75
6000	33	1489	72
8000	30	1432	69
10000	25	1373	66
12000	21	1313	63
14000	17	1250	60
16000	13	1188	57
18000	9	1124	54
20000	5	1062	51
22000	1	987	47
24000	-3	923	44
26000	-7	862	41
28000	-11	802	39
29000	-13	782	38

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CRUISE PERFORMANCE CHARTS

The following cruise performance charts define the recommended settings for maximum engine life.

Maximum Cruise Power at 1900 rpm and ISA-30

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	-15	2073	100
2000	-19	2073	100
4000	-23	2073	100
6000	-27	2073	100
8000	-30	2073	100
10000	-35	2073	100
12000	-39	2073	100
14000	-43	1947	94
16000	-47	1821	88
18000	-51	1695	80
20000	-55	1516	73
22000	-59	1366	66
24000	-63	1227	59
26000	-67	1102	53
28000	-71	988	48
29000	-73	930	45

Maximum Cruise Power at 1900 rpm and ISA-15

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	0	2073	100
2000	-4	2073	100
4000	-8	2073	100
6000	-12	2073	100
8000	-15	2073	100
10000	-20	2028	98
12000	-24	1907	92
14000	-28	1792	86
16000	-32	1679	81
18000	-36	1568	75
20000	-40	1464	70
22000	-44	1357	65
24000	-48	1249	60
26000	-52	1128	54
28000	-56	1012	49
29000	-58	954	46

Maximum Cruise Power at 1900 rpm and ISA

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	15	2073	100
2000	11	2073	100
4000	7	2073	100
6000	3	2067	99
8000	0	1951	94
10000	-5	1844	89
12000	-9	1737	84
14000	-13	1633	79
16000	-17	1532	74
18000	-21	1433	69
20000	-25	1341	64
22000	-29	1245	60
24000	-33	1145	55
26000	-37	1057	51
28000	-41	975	47
29000	-43	935	45

Maximum Cruise Power at 1900 rpm and ISA+15

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	30	2048	98
2000	26	1979	95
4000	22	1901	91
6000	18	1819	87
8000	15	1720	83
10000	10	1634	79
12000	6	1549	74
14000	2	1464	70
16000	-2	1380	66
18000	-6	1297	62
20000	-10	1216	58
22000	-14	1134	54
24000	-18	1038	50
26000	-22	959	46
28000	-26	884	43
29000	-28	850	41

Maximum Cruise Power at 1900 rpm and ISA+30

Pressure Altitude (ft)	Outside Air Temperature (OAT) (°C)	Torque (ft-lb)	Torque (%)
Sea Level	45	1742	84
2000	41	1696	82
4000	37	1638	79
6000	33	1572	76
8000	30	1489	72
10000	25	1421	68
12000	21	1352	65
14000	17	1283	62
16000	13	1213	58
18000	9	1143	55
20000	5	1076	52
22000	1	1005	48
24000	-3	923	44
26000	-7	854	41
28000	-11	789	38
29000	-13	761	37

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SAFETY INFORMATION

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INTRODUCTION

Your Lancair aircraft is an extremely high-quality aircraft and one which will provide years of service given the care a fine machine deserves. Like most other pieces of equipment, your aircraft will operate best under certain conditions, and can be dangerous in others. We have attempted to identify the latter in this manual. Now we will offer some suggestions for the safe operation of this 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 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 aircraft 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 you, we will include that feedback, providing you with the benefit of what others have learned.

WARNING

Lancair aircraft are high-performance aircraft. All safety precautions must be observed to reduce to the maximum extent possible injury to the pilot(s) or passengers.

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.

Set standards for your performance and understand why you were not quite on the mark, e.g. total fuel used on this trip. 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

You may want the first flight in your Lancair to be performed by a professional test pilot to determine the aircraft's flight characteristics. Contact information for recommended test pilots may be obtained from Lancair.

Should you choose to perform your own first flight it is only prudent that you obtain initial type specific training. 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 whatsoever.

Preflight your aircraft as if it is a game. Someone has deliberately introduced a fault into the aircraft - try to find it. If you make your preflight without a checklist in hand, go over the checklist in the cockpit to see if you checked each item. Once in the cockpit use your checklist religiously. Was the fuel level correct for both wing tanks? Is it adequate for the trip intended? Always keep the header tank at 1/2 or more. Baggage (secured of course) is not excessive such that gross weight or CG is out of limits? Mentally review the flight from take off through 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:

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
9O-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.

FLIGHT PLANS

Plan your flight and fly your plan. These are words worth remembering and following. “Planning” means checking the weather, NOTAMs, aircraft, and planning “what ifs” 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”.

There are countless sources of information available for flight planning that include all aspects of weather, notams, computed flight plans based on aircraft performance profiles, etc. These include, but are not limited to, AOPA’s website, www.fltplan.com (free comprehensive service), DUATS, and NOAA.

MOUNTAIN FLYING

Flight of small aircraft over mountains and in mountainous areas is different from “flatlander” 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 advice of "locals" before venturing into this unknown. They can provide you with required/desired equipment, best routes, service possibilities and such to make your crossing more comfortable. Nights and mountains almost always call 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 aircraft 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.

ICING

Your Lancair aircraft 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 aircraft with ice have not been evaluated. AVOID!

Flight into known icing is prohibited. Flight into inadvertent icing is not to be treated lightly. Remember that other systems may be affected such as the pitot system. If flying in IMC conditions have the pitot heat ON.

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 AND 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
4. 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 simply 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 hypoxia. 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 relative 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; hold your breath followed by slow and deliberate breathing. 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, thus moving to a 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 blood's ability to carry oxygen to the brain. Avoid them for your safety and that of your passengers. The presence of carbon monoxide in the cockpit can result in similar symptoms.

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. 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 through 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 making 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. For example, oil consumption increases, vibration increases due to a 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 engine 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.

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.

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.

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