Pilot's Operating Handbook

ARION AIRCRAFT LLC

Pilot's Operating Handbook

Publication Number: AAPOHLS-1, Issue B

Revision Date: 1 December 2011

Airplane Name & Model Number: Lightning LS-1

Airplane Registration Number: _____

Airplane Serial Number: _____

POH Date of Issue: 1 December 2011

This Handbook must be kept current and carried within the aircraft at all times.

Arion Aircraft, LLC

2842 Highway 231 North

Shelbyville, TN 37160

Record of Manual Revisions

Revision	Date	Pages/ Section	Description	Signature
Original		All	Initial Release	Arion Aircraft, LLC
A1	27 May 2010	All	CG Range	Arion Aircraft, LLC
A1	27 May 2010	All	Flap range limited to 25	Arion Aircraft, LLC
Issue B	1-Dec-2011	All	ASTM F2746 Compliance	Arion Aircraft, LLC

THIS PAGE INTENTIONALLY BLANK

List of Effective Sections

The table below shows the current effective sections and dates in this revision of the handbook. The applicable handbook revision is listed on the lower left corner of this page. Supplements are issued and controlled separately by the Log of Supplements in Section 10.

Section	Change	Date
Table of Contents	B0	1-Dec-2011
Foreword	B0	1-Dec-2011
Section 1	B0	1-Dec-2011
Section 2	B0	1-Dec-2011
Section 3	B0	1-Dec-2011
Section 4	B0	1-Dec-2011
Section 5	B0	1-Dec-2011
Section 6	B0	1-Dec-2011
Section 7	B0	1-Dec-2011
Section 8	B0	1-Dec-2011
Section 9	B0	1-Dec-2011

THIS PAGE INTENTIONALLY BLANK

Table of Contents

Section 3: Emergency Procedures

Section 4: Normal Procedures

Section 5: Performance

Section 9: Supplements

Introduction

ASTM Standards

Certain FAA-accepted ASTM standards were referenced for the design, construction, and continued airworthiness of the Lightning LS-1. This aircraft complies with the following standards:

- F2245 Standard Specification for Design and Performance of a Light Sport Airplane
- F2279 Standard Practice for Quality Assurance in the Manufacture of Fixed Wing Light Sport Aircraft
- F2295 Standard Practice for Continued Operational Safety Monitoring of a Light Sport Aircraft

This handbook includes the material required to be furnished to the pilot by ASTM Standard F2245 as well as additional information provided by Arion Aircraft.

Continued Airworthiness

MANUFACTURER CONTACT DETAILS

Name: Arion Aircraft, LLC

2844 Highway 231 North

Shelbyville, TN 37160 USA

Telephone: 931-680-1781

Fax: 931-680-1535

Email: info@flylightning.net

Website: www.flylightning.net

SERVICE DIFFICULTY/SAFETY OF FLIGHT

FAA required Continued Operational Safety Monitoring systems require the cooperation of both the aircraft owner/operators and manufacturer. Service difficulties or potential safety of flight issues must be reported to the Manufacturer on the Service Difficulty Report form located in the Aircraft Maintenance Manual.

OWNER CONTACT INFORMATION UPDATE

It is mandatory for LS-1 owners to keep their contact information updated with Arion Aircraft, LLC so they may receive documentation revisions and safety information. Responsibility for address changes lies solely with the owner/operator of the aircraft.

FAA regulations mandate that owners and operators of this aircraft maintain this Pilot's Operating Handbook to current revision status.

If owner/operators do not maintain this Pilot's Operating Handbook with current revisions and comply with manufacturer's Service Bulletins and Air Safety Alerts, the Airworthiness Certificate of the aircraft may become invalid.

In the event of changes to email address and/or postal address, please submit the updated information to the manufacturer using the contact details above.

RECOVERY OF CERTIFICATION DOCUMENTATION

Should certification documentation need to be recovered for this aircraft, please contact the manufacturer. In the event that the manufacturer discontinues support of the aircraft, a notice shall be mailed to each registered owner with new contact information for support.

Owner/Operator Responsibilities

To maintain compliance with ASTM Standard F2295, the owner or operator of this aircraft must follow six rules that are specified in Section 5.4 of F2295. Failure to comply with these responsibilities could result in an aircraft that may be out of compliance with the ASTM standards and could lead to revocation of the aircraft airworthiness certificate.

1. Each owner/operator of this aircraft shall read and comply with the maintenance and continued airworthiness information and instructions provided by the manufacturer.
2. Each owner/operator of this aircraft shall be responsible for providing the manufacturer with current contact information where the manufacturer may send the owner/operator supplemental notification bulletins.
3. The owner/operator of this aircraft shall be responsible for notifying the manufacturer of any safety of flight issue or significant service difficulty upon discovery.
4. The owner/operator of this aircraft shall be responsible for complying with all manufacturer notices of corrective action and for complying with

all applicable aviation authority regulations in regard to maintaining the airworthiness of this aircraft.

5. The owner/operator of this aircraft shall ensure that any needed corrective action be completed as specified in a notice, or by the next scheduled annual inspection.

6. Should an owner not comply with any mandatory service requirement, the aircraft shall be considered not in compliance with applicable ASTM standards and may be subject to regulatory action by the presiding aviation authority.

Handbook Information

- This Pilot's Operating Handbook (POH) is provided by Arion Aircraft, LLC as a guide to the operation of the Lightning LS-1.
- This POH applies to the particular aircraft identified by the registration marking and serial number on the cover page and contains the airworthiness limitations and essential operating data for this aircraft only. A POH with no identifying aircraft serial number must be used for ground study only.

- This aircraft has been qualified for compliance to the Light Sport regulations on the basis of the equipment fitted at the time of qualification.
- This POH must be carried in the aircraft on all flights.
- The pilot in command of the aircraft must comply with all requirements, procedures, and limitations with respect to the operation of the aircraft set out in this POH.
- For operating information not included in this manual, reference should be made to the appropriate operations or manufacturer's manuals.

REVISIONS & CHANGES

This handbook utilizes section-level revision control. Each page of the handbook contains a revision indication in the lower, inside corner. Revision indicators are consistent throughout an entire section, but vary from section to section.

A major release of the handbook is called an "Issue." The issue letter and its effective date are listed on the title page of the handbook using a letter code; for example, "Issue A".

Updates and changes to the handbook are called "Revisions" and are designated using an issue prefix

followed by a number; for example, "Revision A2" is the second revision of "Issue A".

These revisions are listed on the Record of Handbook Revisions page near the front of the handbook. Owners are responsible for keeping this page updated when handbook revisions are issued by Arion Aircraft.

Updates and changes to sections of the handbook are called "Changes" and are designated using the issue prefix followed by a number; for example, "Change A0" is the original release of a section in Issue A and "Change B3" is the third revision of a section in Issue B of the entire handbook.

The "List of Effective Sections" near the front of the handbook documents the applicable section "Changes" associated with a given handbook revision.

Revisions to this Pilot's Operating Handbook will be distributed to all Arion Aircraft dealers and owners of aircraft registered with Arion Aircraft via the website, www.flylightning.net. Revisions will be printed and mailed only upon request.

Distribution will include new pages for the sections that have changed, a new List of Effective Sections, and any necessary instructions. Revisions must be incorporated into this handbook per the instructions provided.

Supplements are issued and controlled separately by the Log of Supplements in Section 9.

It is the responsibility of the owner to maintain this POH in a current status when it is being used for operational purposes. Owners should contact Arion Aircraft whenever the revision status of their POH is in question or if they find discrepancies or errors.

Symbols

This handbook uses the following symbols and definitions to emphasize important information.

- ⬢ WARNING: Identifies an instruction which, if not followed, may cause serious injury or death.
- ❖ CAUTION: Denotes an instruction which, if not followed, may severely damage the aircraft or aircraft hardware.
- ➢ NOTE: Indicates supplementary information that may be required to fully complete or understand an instruction.

Terminology & Abbreviations

TSS	**Takeoff Safety Speed** is the speed designated to ensure that adequate control will exist under all conditions during the climb after takeoff, including turbulence and sudden and complete engine failure.
CAS	**Calibrated Airspeed** means the indicated airspeed of the aircraft corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	**Knots Calibrated Airspeed** is calibrated airspeed expressed in knots.
IAS	**Indicated Airspeed** is the speed of an aircraft obtained from an airspeed indicator uncorrected for airspeed system errors.
KIAS	**Knots Indicated Airspeed** is indicated airspeed expressed in knots.
TAS	**True airspeed** is the airspeed of an airplane relative to undisturbed air which is CAS corrected for altitude and temperature.

KTAS **Knots True Airspeed** is true airspeed expressed in knots.

V_A **Maneuvering Speed** is the maximum speed at which abrupt application of full available aerodynamic control will not over stress the airplane.

V_{FE} **Maximum Flap Extended Speed** is the maximum speed permissible with wing flaps extended in the prescribed position.

V_{NO} **Normal Operating Speed (Maximum Structural Cruising Speed)** is the speed that should not be exceeded except in smooth air, and then only with caution.

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

V_{S1} **Stalling Speed or minimum steady flight speed** at which the airplane is controllable in a specified configuration.

V_{S0} **Stalling Speed or minimum steady flight speed** at which the airplane is controllable in the landing configuration at the forward-most center of gravity.

OAT **Outside Air Temperature** is the free static air temperature, obtained either from in flight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.

RPM **Revolutions Per Minute** is the speed of the engine crankshaft and propeller.

Static RPM **Static RPM** is the engine speed attained during a full-throttle engine run-up when the airplane is on the ground and stationary.

WOT **Wide-Open Throttle** is the power setting at which the throttle is fully open

MCP **Maximum Continuous Power** is the normal cruise RPM in Lightning LS-1 aircraft. It should not be exceeded for any length of time beyond 15 minutes unless required for safety.

Unusable Fuel	**Unusable Fuel** is the quantity of fuel that cannot be safely used in flight.
Station	**Station** specifies a location along the airplane fuselage, usually given in terms of distance from the reference datum. Examples include the Seat Station which is the center of the fixed seats and Fuel Station which is the center of the fixed fuel tank.
Center of Gravity (CG)	**Center of Gravity** is the point at which an airplane, or equipment, would balance if suspended.
Standard Empty Weight	**Standard Empty Weight** is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	**Basic Empty Weight** is the standard empty weight plus the weight of optional equipment.
Useful Load	**Useful Load** is the difference between MTOW and basic empty weight.
MTOW (Gross Weight)	**Maximum Takeoff Weight** is the maximum weight approved for the start of the takeoff run.

Section 1
General Information

1.1 Aircraft Type and Model

The Arion Aircraft Lightning LS-1 has been manufactured to the requirements of the United States Light Sport Aircraft Rule and applicable ASTM Standards accepted by the Federal Aviation Administration.

Type:.....Arion Aircraft Lightning

Model:.....LS-1

Manufacturer:.....Arion Aircraft, LLC

1.2 Three-View Drawing

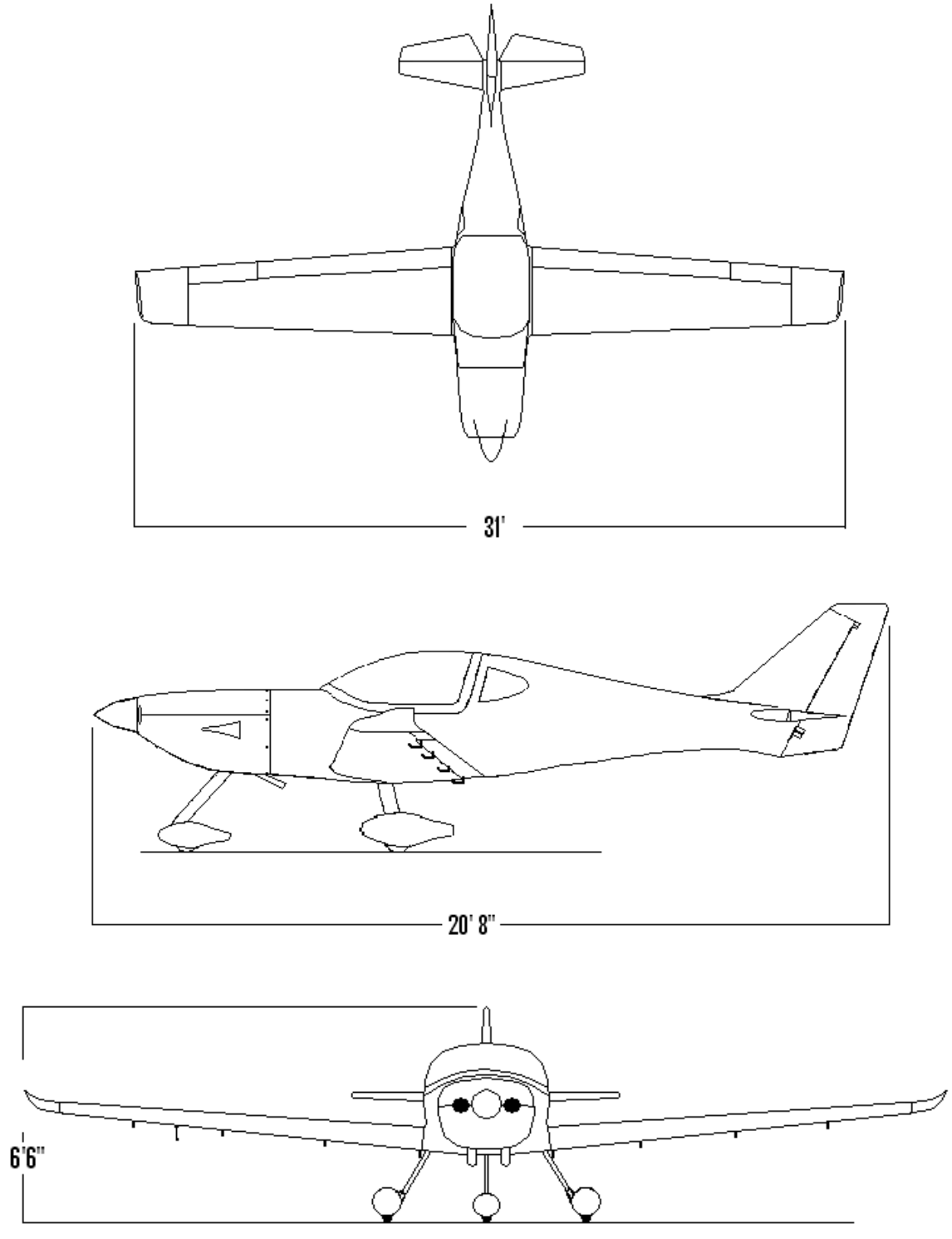


Figure 1-1: Three-View Drawing

1.3 Aircraft Summary

MGTOW	1320 lbs
Top Speed @ Sea Level, WOT (3300 rpm)	140 KIAS
Cruise Speed @ Sea Level, MCP (2850 rpm)	110 KIAS
Cruise Speed @ 8,000' MSL, MCP (2850 rpm)	108 KIAS
Maximum Engine Power Output (3300 rpm)	120 hp
Rate of Climb, MGTOW	1200 fpm
Stall speed, flaps up	45 KIAS
Stall speed, flaps down	40 KIAS
Total Fuel Capacity	30 US gal.
Usable Fuel	28 US gal.
Approved Fuel Grades	100LL
Full Fuel Range (30 gal tanks) (30-min reserve, no wind; assuming 120 KTAS @ 4.5 gph/2850 rpm, 8,500' MSL)	746 nm

THIS PAGE INTENTIONALLY BLANK

Section 2
Operating Limitations

2.1 Introduction

This section includes operating limitations necessary for the safe operation of the airplane, its engine, standard systems and standard equipment.

Observance of these operating limitations is required.

Limitations and instructions included in this section and in applicable supplements must be observed when operating the aircraft.

2.2 Airspeed Limitations

Airspeed limitations and their operational significance are shown below in indicated airspeed.

Speed		KIAS	Remarks
V_{NE}	Never exceed speed (barber pole)	180	Do not exceed this speed in any operation.
V_{NO}	Maximum structural cruising speed (bottom of yellow arc)	110	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering speed	87	Do not make full or abrupt control movements above this speed.
	Max Straight & Level	140	Full power straight and level
V_{FE}	Maximum flap extended speed (top of white arc)	75	Do not exceed this speed with flaps down.
V_{S1}	Stall speed, flaps up	45	At max takeoff weight
V_{S0}	Stall speed, flaps down (bottom of white arc)	40	At max takeoff weight

2.3 Service Ceiling

Service Ceiling ..... 15,000 ft

2.4 Load Factors

Positive Vertical 4.0

Negative Vertical 2.0

2.5 Prohibited Maneuvers

All aerobatic maneuvers, including intentional spins, are prohibited.

2.6 Fuel Limitations

FUEL CAPACITY

Total Capacity ..... 30.0 US gallons

Capacity Each Wing Tank ..... 15.0 US gallons

Total Useable ..... 28.0 US gallons

APPROVED FUEL TYPES AND GRADES

100LL grade aviation gasoline is recommended and approved for all operations.

Automotive fuel is not recommended.

❖ CAUTION: Alcohol of any type or quantity is PROHIBITED.

2.7 Environmental Limitations

Operations in Instrument Meteorological Conditions (IMC).....PROHIBITED

Operations in Day VFR and Night VFR Conditions.....APPROVED

Maximum Demonstrated Crosswind Component.....15 KNOTS

Maximum Air Temperature for Operations.....110°F

2.8 Powerplant Limitations

Instrument	Green Arc	Yellow Arc	Red Arc/ Radial Line
Tachometer (RPM)	2550–2850	2850–3300	3300
Oil Temperature (°F)	122–211	212–244	244
Oil Pressure (PSI)	32–76	11.6–31	80
Cylinder Head Temperature (°F)	167–356	356–394	394

Minimum Oil Temperature for Takeoff	120°F
Minimum Oil Pressure in Level Flight or Climb	32 PSI
Minimum Oil Pressure at Idle Power	11.6 PSI
Maximum Cylinder Head Temperature	394°F
Maximum RPM for All Operations	3300
Maximum Engine Power Output at 3300 rpm	120 hp
Full Throttle Static RPM	2600-3000
Maximum Continuous Engine RPM (cruise)	2850 RPM
Maximum Time for Operating above 2850 RPM	15 minutes

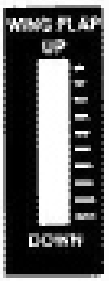
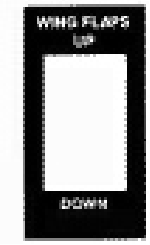
2.9 Other Limitations

Smoking .....Prohibited

Maximum Permissible Number of Occupants.....2

2.10 Required Placards & Markings

Location	Placard
Inside of baggage compartment	**Baggage Compartment** **DO NOT EXCEED 50 LBS IN THIS COMPARTMENT** **LOAD MUST BE PROPERLY RESTRAINED** **REFER TO PILOT'S OPERATING HANDBOOK FOR WEIGHT & BALANCE CALCULATION**
On instrument panel, in plain view of occupants	**Passenger Warning** **THIS AIRCRAFT WAS MANUFACTIRED IN ACCORDANCE WITH LIGHT SPORT AIRCRAFT AIRWORTHINESS STANDARDS AND DOES NOT CONFORM TO STANDARD CATEGORY AIRWORTHINESS REQUIREMENTS** **FLIGHT INTO IMC PROHIBITED** **SPINS AND AEROBATIC MANEUVERS ARE PROHIBITED**
On Instrument Panel Trim Indicator	
On Instrument Panel Trim Switch	

On Instrument Panel Flap Indicator	
On Instrument Panel Flap Switch	
Fuel Selector	

Adjacent to each fuel filler cap. Must be "11 US Gallons" when equipped with standard fuel tanks.	 **15 US Gallons 100LL**
Rear baggage bulkhead or canopy frame	**LIGHT SPORT**
On propeller near the hub (wooden propellers only)	**CAUTION!** **Wood Propellers Require Frequent Bolt Torque Inspection** **Refer to Applicable Maintenance Instructions**

AIRSPEED INDICATOR MARKINGS

Marking	KIAS	Remarks
Red Line	181	VNE: maximum speed for all operations
Yellow Arc	110 – 181	Operations must be conducted with caution and only in smooth air. Arc range is from VNO to VNE.
Green Arc	42 – 110	Normal Operating Range. Lower limit is maximum weight V_S, at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed.
White Arc	38 - 75	Full Flap Operating Range. Lower limit is maximum weight V_{S0}, in landing configuration. Upper limit is V_{FE}, maximum speed permissible with flaps extended.

Section 3
Emergency Procedures

3.1 General Information

This section provides checklists and other procedures for coping with emergencies that may occur. Emergencies caused by airplane malfunction are rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies may be minimized by careful flight planning and good judgment when unexpected weather is encountered. However, should an emergency arise, the guidelines in this section should be considered and applied as necessary to correct the problem.

In any emergency situation, the most important initial actions are:

- First - Maintain aircraft control
- Then - Analyze the situation and take appropriate action
- Land as soon as practicable.

In other words: Do not forget to **FLY THE AIRCRAFT.**

3.2 Airspeeds for Emergency Procedures

Engine Failure After Takeoff .....75 KIAS

Maneuvering Speed (at all weights) .....87 KIAS

Best Glide Speed—Still Air, Flaps UP.....75 KIAS

Precautionary Landing Approach With Engine Power:

Wing Flaps 25°.....60 KIAS

Landing Approach Without Engine Power:

Wing Flaps Up.....75 KIAS

Wing Flaps 25°.....60 KIAS

3.3 Engine Failure Checklists

ENGINE FAILURE DURING TAKEOFF RUN

Throttle.....IDLE

Brakes.....APPLY

Ignition.....OFF

Master Switch.....OFF

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

1. Airspeed.....75 KIAS
2. Fuel Selector.....OFF
3. Ignition.....OFF
4. Wing Flaps.....AS REQUIRED
5. Master Switch.....OFF
6. LAND.....Safest Available Area

ENGINE FAILURE DURING CRUISE

7. Airspeed.....BEST GLIDE ANGLE 75 KIAS
8. Carburetor Heat.....ON
9. Fuel Boost Pump.....ON
10. Fuel Selector Valve .....FULLEST TANK
11. Ignition.....TEST-- Cycle L, R, Both
12. Air Start.....ATTEMPT if time permits

If engine fails to restart:

13. Emergency Landing.....PERFORM

- NOTE: If clear evidence of mechanical failure exists or if engine has seized due to loss of oil pressure, do not attempt a restart.
- NOTE: If engine runs on L or R but not BOTH, switch to good system while a suitable landing area is chosen.
- NOTE: In the event that the engine is stopped during flight, it may be restarted by application of fuel and ignition without use of starter motor if propeller is still windmilling.
- NOTE: The JABIRU 3300 engine is a high compression (8:1) engine. Therefore, when the propeller has stopped rotating, air starts without use of starter are unlikely before reaching V_{NE} or 140 KIAS.
- CAUTION: DO NOT engage starter if propeller is windmilling.

AIR START

1. Establish Glide.....75 KIAS

2. Throttle.....IDLE
3. Choke.....AS NEEDED
   if engine has cooled significantly during glide
4. Master Switch.....ON
5. Fuel Boost Pump.....ON
6. Fuel Selector Valve.....ON FULLEST TANK
7. Ignition.....START if prop stopped
8. If engine fails to restart, perform Emergency Approach and Landing.

3.4 Emergency Approach and Landing

EMERGENCY APPROACH AND LANDING WITHOUT ENGINE POWER

1. Landing Area.....CHOOSE
   and establish landing pattern
2. Airspeed.....75 KIAS (Flaps UP)
   .....60 KIAS (Flaps DOWN)

As Altitude Allows:

3. Ignition.....OFF
4. Fuel Selector Valve.....OFF
5. Wing Flaps.....AS REQUIRED

6. Seatbelts.....TIGHTEN
7. Canopy.....UNLATCH
8. Master switch.....OFF
   after final approach is established
9. Touchdown.....SOFT-FIELD TECHNIQUE
10. Brakes.....AS REQUIRED

PRECAUTIONARY OFF-AIRPORT LANDING WITH ENGINE POWER

1. Airspeed.....75 KIAS
2. Carburetor Heat.....ON
3. Fuel Pump.....ON
4. Selected Field.....FLY OVER
   noting terrain and obstructions
5. Landing Pattern.....ESTABLISH
6. Wing Flaps.....AS REQUIRED
7. Airspeed.....60-65 KIAS
8. Touchdown.....SOFT-FIELD TECHNIQUE
9. Ignition Switch.....OFF
10. Brakes.....AS REQUIRED

WATER LANDING

1. Radio.....TRANSMIT MAYDAY on area frequency and on 121.5 MHz, giving location and intentions
2. Heavy Objects.....SECURE
3. Approach.....ESTABLISH
   High Winds, Heavy Seas — INTO WIND
   a. Light Winds, Heavy Swells — PARALLEL TO SWELLS
4. Wing Flaps.....FULL DOWN
5. Canopy.....UNLATCH
6. Descent Rate.....ESTABLISH 50 fpm/60 KIAS
7. Touchdown.....TAIL LOW
8. Face.....CUSHION at touchdown with folded coat or cushion
9. Airplane.....EVACUATE If necessary, break canopy.
10. Life Vests.....INFLATE

3.5 Fire Procedures

FIRE DURING START ON GROUND

1. Cranking.....CONTINUE to get a start, which would suck the flames and accumulated fuel through the carburetor and into the engine.

If engine starts:

2. Power.....1500 RPM
3. Fuel Boost Pump.....OFF
4. Fuel Selector Valve.....OFF and allow engine to empty carburetor
5. Engine.....INSPECT for damage

If engine fails to start:

6. Ignition.....OFF
7. Fuel Selector Valve.....CONFIRM OFF
8. Electrical Switches.....OFF
9. Aircraft.....EXIT
10. Fire.....EXTINGUISH using fire extinguisher, wool blanket, or dirt.
11. Fire Damage.....INSPECT AND REPAIR

ENGINE FIRE IN FLIGHT

1. Throttle.....CLOSED
2. Main Fuel Shutoff Valve.....OFF
3. Fuel Boost Pump.....OFF
4. Ignition.....OFF
5. Cabin Heat.....CLOSED
6. Cabin Vents.....CLOSED
7. Airspeed.....INCREASE UP TO VNE
   if required to extinguish fire.
8. Emergency Landing..... EXECUTE

ELECTRICAL FIRE IN FLIGHT

1. Master Switch.....OFF
2. All other switches.....OFF
3. Cabin Vents.....OPEN

If fire does not go out:

4. Emergency Landing.....EXECUTE

If fire appears to be out:

5. Master Switch.....ON
6. Circuit Breakers.....CHECK
   for faulty circuit, DO NOT reset.

7. Radio/Electrical Switches.....ON ONE AT A TIME with delay after each until short circuit is localized
8. Aircraft.....LAND as soon as practical to inspect for damage.

CABIN FIRE

1. Master Switch.....OFF
2. Cabin Heat.....OFF
3. Vents/Cabin Air.....CLOSED until fire extinguished
4. Land as soon as possible to inspect for damage.

3.6 Electrical System Malfunctions

"LOW VOLTAGE" WARNING

1. Alternator Failure.....DETERMINE
    a. Engine Tachometer....."0 RPM"
    b. System Voltage.....12.0 or less
2. Battery Power.....CONSERVE
    a. TURN OFF unnecessary electrical items
3. Aircraft.....LAND as soon as practical

"HIGH VOLTAGE" WARNING

1. Throttle.....REDUCE as necessary to reduce alternator output, but NOT enough to cause an unsafe flight condition
2. Master Switch.....CYCLE

If high voltage warning continues:

3. Master Switch.....OFF unless electricity is essential to safety of flight
4. Aircraft.....LAND as soon as practical

CIRCUIT BREAKER TRIP

1. Circuit Breaker.....NOTE tripped circuit breaker
2. Equipment on tripped circuit breaker..... OFF
3. Circuit Breaker.....RESET

If circuit breaker trips again, DO NOT RESET:

4. Aircraft.....LAND as soon as practical

MASTER SWITCH CIRCUIT BREAKER TRIP

1. Aircraft.....LAND as soon as practical
2. Master Switch Circuit Breaker.....RESET by flipping switch to ON position
3. Engine.....RUN

If main circuit breaker trips again:

4. RECTIFY before continuing flight.

LOSS OF PRIMARY FLIGHT INSTRUMENTS

1. EFIS circuit breaker.....CYCLE
2. If EFIS does not restart.....PULL BREAKER
3. Aircraft.....LAND as soon as practical

3.7 Engine Troubleshooting

CARBURETOR ICING

1. Carb Heat.....PULL ON
2. Throttle.....OPEN AND CLOSE RAPIDLY to break ice free from throttle plate.
3. Carb Heat.....ON for a period of at least one minute

IGNITION MALFUNCTION

1. Ignition Key.....SWITCH to R, then L
2. Ignition Key.....LEAVE on smoothest magneto
3. Aircraft.....LAND as soon as practical

- NOTE: A sudden engine roughness or misfiring is usually evidence of ignition problems. The problem could be a malfunctioning ignition system component, fouled spark plug, or simply a loose spark plug wire. Switching the ignition key from BOTH to L or R will identify which of the two systems is malfunctioning.

❖ CAUTION: Do not place key in "START" position while propeller is turning.

LOW OR HIGH OIL PRESSURE WARNING

1. Oil Pressure.....CHECK
2. Oil Temperature.....CHECK
3. Cylinder Head Temperatures (CHT) .....CHECK
4. Indication of Oil Leak (visual, smell).....CHECK
5. Engine Operation.....OBSERVE for smoothness

If all above indications are normal:

6. Aircraft.....LAND as soon as practical and check engine for oil quantity and leakage.

If engine roughness, leaking oil, or high or rising CHT/Oil Temp is observed:

7. Aircraft.....PREPARE for engine stoppage and emergency approach and landing. LAND at nearest airport or safe area.

➢ NOTE: High oil temperatures and low oil pressures may be associated with overfilling engine crankcase with oil. See Section 8 of this manual for proper oil filling instructions.

- NOTE: If oil pressure spikes to a high number or fluctuates suddenly while ALL other engine vitals are normal and the engine keeps running smoothly, the oil pressure sender may be faulty. Land as soon as practical to verify and correct.

HIGH CHT WARNING

In Flight:

1. Climb Angle.....REDUCE
   Lower nose to increase volume of air through cooling ducts.
2. Throttle.....REDUCE
   slightly if necessary
3. CHTs.....OBSERVE
   If CHTs do not stabilize below 356°F within 5 minutes of corrective action:
4. Aircraft.....LAND
   at nearest airport and check inlets for blockage.

High CHT on the ground:

1. Aircraft.....TURN into the wind
2. CHTs.....OBSERVE
   If CHTs continue to rise or do not decrease below 356°F within 2 minutes of corrective action:
3. Shut engine down until CHTs stabilize below 356°F.

LOW CHT WARNING in flight:

1. Descent rate.....DECREASE
2. Throttle.....1800 RPM until CHTs warmer than 167°F

❖ CAUTION: Do not exceed 1800 RPM with CHT below minimum threshold unless necessary to maintain safe altitude.

3.8 Inadvertent Spin

Aerobatic maneuvers, including spins, are prohibited. While inadvertent spins are unlikely, should this occur, proceed as follows:

1. Throttle.....IDLE
2. Ailerons.....NEUTRAL
3. Rudder.....APPLY FULLY AND HOLD in direction OPPOSITE OF ROTATION

Just AFTER rudder reaches the stop:

4. Control Stick..... FORWARD to break stall. Full down elevator may be required for recovery at aft CG loadings.
5. Control Inputs.....HOLD UNTIL ROTATION STOPS Premature relaxation of control inputs may extend the recovery.

As Rotation Stops:

6. Controls.....NEUTRALIZE and smoothly recover from resulting dive.

3.9 Emergency Descent

1. Throttle.....IDLE
2. Carb Heat.....PULL ON
3. Flaps.....VERIFY UP
4. Aircraft.....SPIRAL DOWN
5. Airspeed.....BELOW 180 KIAS AT ALL TIMES

3.10 Inadvertent Icing

Flight into areas of known, forecast or probable icing is PROHIBITED. Proper preflight planning is essential to avoidance of airframe ice.

AT THE <u>FIRST</u> SIGN OF AIRFRAME ICING:

1. Aircraft.....CHANGE DIRECTION OR ALTITUDE to find an OAT less conducive to airframe ice and/or avoid visible moisture.

3.11 Loss of Flight Controls

In any situation where flight controls appear inoperable, consider the following:

1. **ENSURE AUTOPILOT IS OFF** and not causing a perceived control failure.

2. If stable cruise flight is possible, find the nearest airport with a large open runway into the wind and, ideally, crash rescue equipment.

3. Autopilot may be used to assist in pitch and/or roll, depending on the nature of the failure.

5. Use wing flaps with caution, as they will affect pitch attitude and airspeed.

3.12 Abnormal Events & Procedures

CANOPY OPEN IN FLIGHT

1. Aircraft.....MAKE NORMAL LANDING as soon as practical, then latch canopy.

➢ NOTE: The Lightning has a front-hinged canopy which will float open a few inches in the slipstream during flight. An unlatched canopy does not affect aircraft handling, but is IMPOSSIBLE to close and latch in flight due to aerodynamic forces. NEVER allow an open canopy to distract you from safely flying the aircraft!

NO-FLAP LANDING

1. Approach Airspeed.....65 KIAS
2. Wing Flaps.....UP
3. Touchdown.....MAIN WHEELS FIRST
4. Nose Wheel.....LOWER GENTLY
5. Brakes.....AS REQUIRED

- NOTE: Normal landing distance increases significantly when landing with flaps UP.

LANDING WITH A FLAT MAIN TIRE

1. Wing Flaps.....FULL DOWN
1. Approach.....NORMAL
2. Touchdown.....GOOD TIRE FIRST, holding airplane off flat tire as long as possible with aileron control and maintaining runway centerline with rudder. Consider touching down on side of runway opposite that of bad tire to allow room for possible yaw after touchdown.

THIS PAGE INTENTIONALLY BLANK

Section 4
Normal Procedures

4.1 Introduction

This section provides checklists and other procedures for the conduct of normal operations.

4.2 Speeds for Normal Operation

The following speeds are based on a maximum weight of 1320 lbs and may be used for any lesser weight.

Normal Takeoff:

Initial Climb Out, Flaps 10° .....75 KIAS

Short Field Takeoff, 10° Degrees Flap:

Speed at 50 Feet.....70 KIAS

Clear of Obstacles, Flaps Up.....85 KIAS

Climb, Flaps Up:

Normal.....80 KIAS

Best Rate of Climb (V_y).....80 KIAS

Best Angle of Climb (V_x) .....75 KIAS

Landing Approach:

Normal Approach, Flaps 25°.....52 KIAS

Short Field Approach, Flaps Full.....52 KIAS

Balked Landing:

FULL POWER, allow speed to increase to 70 KIAS

Clear of obstacles, Flaps 10°.....70 KIAS

Flaps UP, Normal Climb.....85 KIAS

Maximum Recommended Turbulent

Air Penetration Speed .....90 KIAS

4.3 Preflight Inspection

Prior to flight, the aircraft should be inspected in accordance with the following checklists and in the sequence shown in Figure 7-1.

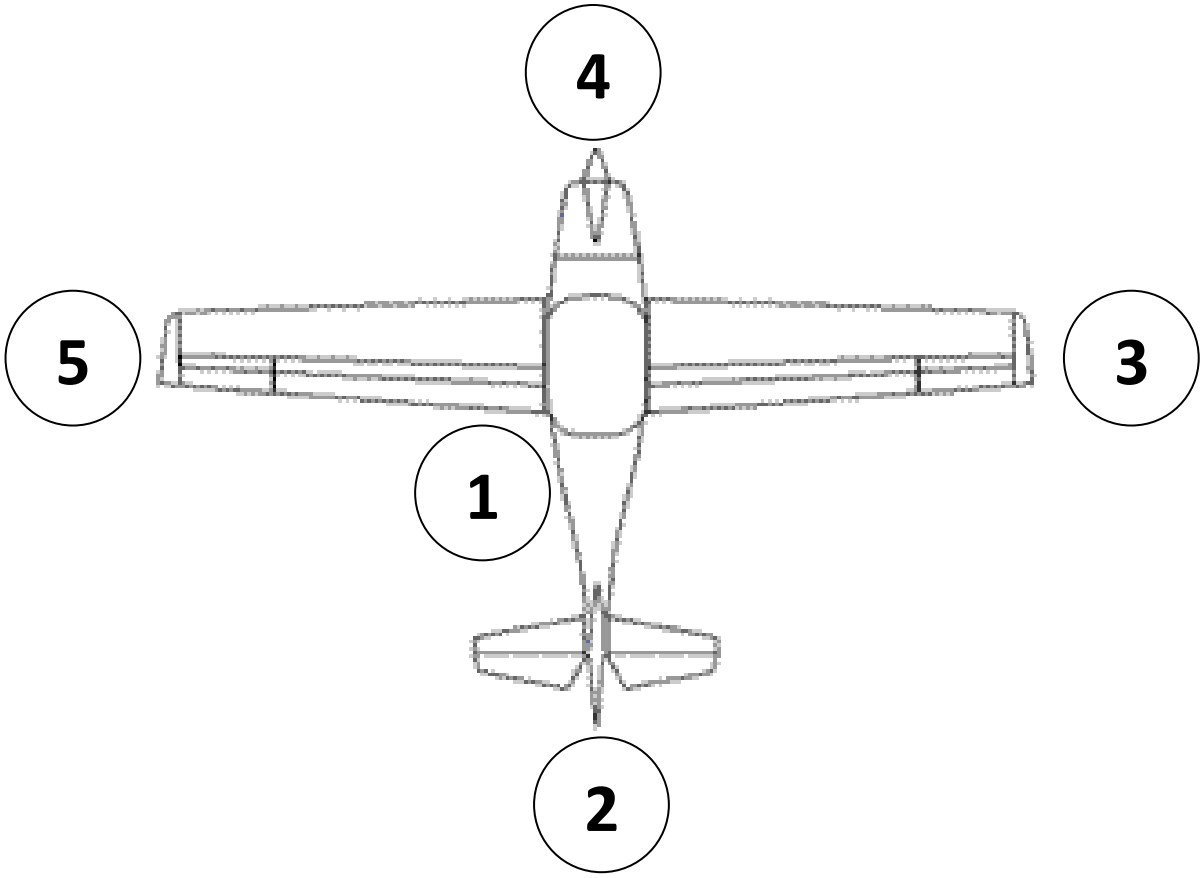


Figure 7-1: Preflight Inspection

PREFLIGHT FLOW CHART (Use with Figure 7-1)

1	Ignition	Off
	Master Switch	Off
	Avionics	As required
	Flight Controls	Free to move to all stops
	Canopy	Check latch and cleanliness
	Cockpit	Secure all loose objects
	Optional	Lower flaps to aid entry into aircraft
2	Rear Fuselage	General surface condition
	Rudder	Condition, attachment, movement
	Elevators	Condition, attachment, movement
	Trim Tab	Condition, attachment, servo door & pushrod
3	Right Wing	Surface condition
	Flap	Attachment & condition
	Aileron	Movement and attachment
	Wing Tip	Lights & condition
	Wheel & Brake	Condition and fluid leaks
	Wheel Fairings	Condition and attachment
	Bottom surfaces	Overall condition wing & fuselage
	Pitot Tube	Clear
	Fuel Sump	Drain sample, check for contaminants
	Fuel Tank Vent	Clear
	Fuel Quantity	Visually Check

4	Engine Cowling	Condition & security, air ducts clear
	Prop/Spinner	Condition & security
	Oil	Check quantity & add if necessary
	Engine	Visual inspection
	Nose Gear	Check tire condition
5	Left Wing	Surface condition
	Fuel Quantity	Visually Check
	Fuel Sump	Drain sample, check for contaminants
	Wheel & Brake	Condition and fluid leaks
	Wheel Fairings	Condition and attachment
	Lower surfaces	Overall condition of wing & fuselage
	Wing Tip	Lights & condition
	Fuel Tank Vent	Clear
	Aileron	Movement and attachment
	Flap	Attachment & condition

- WARNING: In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Make sure that control rods and cables are totally free of ice and move freely.

PREFLIGHT CHECKLIST

1. CHECK FUEL

a. Fuel Filler Cap.....REMOVE

b. Fuel Quantity.....CHECK VISUALLY for desired level in tank by using dipstick

c. Fuel Quick-Drains.....SAMPLE

- NOTE: Before first flight of the day and after each refueling, use sampler cup and drain small quantity of fuel from each fuel tank quick-drain and check for water and sediment.

d. Fuel Filler Cap.....SECURE

2. CABIN

a. Pilot's Operating Handbook.....AVAILABLE in the airplane within reach of PIC

b. Control Lock.....REMOVE and check controls for free motion

c. Ignition.....OFF

d. Master Switch.....OFF

e. INST Switch.....OFF

f. Fuel Selector Valve.....ON Fullest Tank

g. Seatbelts and Shoulder Harnesses.....CHECK condition and security

h. Rudder pedals.....CHECK for proper position

i. Engine Controls.....CHECK for full and free travel

j. Baggage.....SECURE and within weight & balance limits

3. REAR FUSELAGE

a. Tail Tie-down.....DISCONNECT

b. Rudder.....CHECK freedom of movement, control cables and and hinge security

c. Elevator.....CHECK freedom of movement, control rod and hinge security

d. Trim Tab.....CHECK security of hinge, servo door and trim pushrod

4. RIGHT WING-Trailing Edge

a. Flap.....CHECK hinge security

b. Aileron.....CHECK freedom of movement and hinge security

c. Aileron Control Rod.....CHECK control bolts, nuts, and control rod for security. CHECK aileron rod end bearings for freedom of rotation and excessive movement.

5. RIGHT WING

a. Wing Tiedown.....DISCONNECT

b. Wing Tip Lights.....CHECK condition and operation

c. Right Fuel Vent.....CHECK for blockage

d. Landing Light.....CHECK for condition and operation

e. Pitot Tube.....REMOVE cover and CHECK openings for blockage

f. Right main gear leg.....CHECK condition

g. Right main wheel fairing.....CHECK condition and security

h. Right brake.....CHECK for condition and fluid leaks

i. Right main tire .....CHECK for proper inflation and excessive wear or damage

j. Underwing Surfaces.....CHECK for damage

6. NOSE

a. Engine Oil Level.....CHECK and ADD oil if necessary. Clean up any spilled oil.

- NOTE: Normal cold engine oil level is no more than halfway between dipstick hash marks. Normal warm engine oil level is 1/8” from bottom of dipstick.
- NOTE: Excess oil may cause higher than normal oil temperature and lower than normal oil pressure. Excess oil in the system vents into oil recovery bottle.

b. Cowl.....CHECK security of Camlock fasteners and lower cowl attachment screws

c. Lower Cowl.....INSPECT outlet for evidence of oil leaks

d. Air inlets .....CHECK for blockages

e. Propeller and Spinner.....CHECK for damage and security

f. Nose Wheel Fairing.....CHECK for security and condition

g. Nose Tire.....CHECK for proper inflation, SECURITY, and excessive wear or damage

h. Canopy.....INSPECT for condition, clean if necessary

7. LEFT WING

a. Left main gear leg.....CHECK condition

b. Left main wheel fairing.....CHECK condition and security

c. Left brake.....CHECK for condition and fluid leaks

d. Left main tire.....CHECK for proper inflation and excessive wear

e. Left Wing Tiedown.....DISCONNECT

f. Landing Light.....CHECK for condition and operation

g. Left Fuel Vent.....CHECK for blockage

h. Wing Tip Lights.....CHECK condition and operation

8. LEFT WING-Trailing Edge

a. Aileron.....CHECK freedom of movement and hinge security

b. Aileron Control Rod.....CHECK control bolts, nuts, and control rod for security. CHECK aileron rod end bearings for freedom of rotation and excessive movement.

c. Flap.....CHECK hinge security

4.4 Aircraft Operational Checklists

Refer to Flight Training Supplement for detailed information regarding operation of the aircraft and flying techniques.

BEFORE STARTING ENGINE

1. Preflight Inspection.....COMPLETE
2. Seatbelts & Shoulder Harnesses.....ADJUST & LOCK
3. Fuel Selector Valve.....ON fullest tank
4. INST Switch.....OFF
5. Brakes.....TEST & HOLD

COLD ENGINE START

1. Carburetor Heat.....OFF
2. Choke.....ON

3. Throttle.....FULLY CLOSED
4. Master Switch.....ON
5. Fuel Boost Pump.....ON
6. Brakes.....APPLY & HOLD
7. Propeller Area.....VERIFY CLEAR
8. Ignition.....START
9. Ignition.....BOTH after engine starts
10. INST Switch.....ON
11. Engine Instruments.....MONITOR
12. Throttle.....ADJUST for 900–1000 RPM
13. Choke.....CLOSE SLOWLY

- NOTE: If engine cranks below 300 RPM, it will not start. If system voltage drops below 10.5V, do not attempt further start until battery is recharged or external power source is applied.
- NOTE: With throttle closed and choke on, engine may idle at approximately 1200 RPM. Idle speed will reduce as choke is closed.

❖ CAUTION: If oil pressure does not reach at least 11.6 PSI within 10 seconds of engine start, shut down the engine immediately and determine the cause.

❖ CAUTION: If engine needs choke to idle normally beyond an oil temperature of 120°F, service may be required. DO NOT attempt takeoff with choke in ON position.

COLD WEATHER OPERATIONS

For engine start in temperatures below 32°F, preheating is recommended. A warm air source should be directed through the rear opening in the lower cowling to warm the carburetor, intake manifold, and engine oil sump.

Once the intake area is sufficiently warm, start engine using the Cold Engine Start procedure. LET ENGINE WARM ITSELF to normal operating oil temperature and CHT with not more than 1200 rpm.

Installation and use of a Tanis® engine heater is recommended for frequent operation in cold weather. They are available through Arion Aircraft.

❖ CAUTION: Use caution when preheating engine to avoid directing extremely hot air onto SCAT hoses, cowling skins, or other materials that may be damaged by heat.

HOT ENGINE START

Proceed as for Cold Engine Start, but with Choke and Fuel Boost Pump OFF.

FLOODED ENGINE START

If an engine start is attempted with too much choke (for example, full choke applied to a hot engine), the engine may flood. Waiting for the fuel to vaporize will usually allow normal start after several minutes. Otherwise, the following procedure may be followed immediately after the engine floods.

1. Brakes.....APPLY & HOLD
2. Choke.....OFF
3. Fuel Boost Pump.....OFF
4. Throttle.....3/4 OPEN
5. Master Switch.....ON
6. Propeller Area.....CLEAR
7. Ignition.....START, then BOTH after engine starts

8. Throttle.....REDUCE to IDLE as engine starts

ENGINE WARM-UP

1. Throttle.....Not Above 1200 RPM until oil temperature reaches 90°F

❖ CAUTION: During engine warm-up, keep unnecessary items switched off until warm-up is complete to avoid overloading the charging system.

❖ CAUTION: Monitor cylinder head temperatures and turn aircraft into the wind if necessary to aid engine cooling during ground operations.

TAXIING

1. Area.....CLEAR
2. Brakes.....TEST and RELEASE
3. Throttle.....SLOWLY ADVANCE
4. Steering.....USE DIFFERENTIAL BRAKING to assist rudder control at low taxi speeds.
5. See Section 4.5 for information on taxiing in windy conditions.

BEFORE TAKEOFF

1. Brakes.....CHECK and SET
2. Canopy.....CLOSED and LATCHED
3. Flight Controls.....FREE and CORRECT
4. Flight Instruments and Avionics.....SET
5. Fuel Selector Valve.....ON Fullest Tank
6. Elevator Trim.....NEUTRAL
7. Wing Flaps.....SET 10° (normal takeoff)

Engine Run-Up

1. Throttle.....1800 RPM
2. Ignition.....CHECK MAGS (R- BOTH, L-BOTH)
    a. Normal drop 10-30 RPM
    b. If drop exceeds 100 RPM, inspect ignition system prior to flight.
3. Carburetor Heat and Idle Check
    a. Throttle.....1800 RPM
    b. Carburetor Heat.....PULL to ON
    c. Engine Speed.....CHECK for RPM drop.

➢ NOTE: If no ice is present, there will be little or no drop in rpm. See Section 7.8 for more information on Carb Heat system.

4. Throttle.....REDUCE TO IDLE
   Engine should idle smoothly with Carb Heat ON.
5. Carburetor Heat.....OFF
6. Engine Speed.....800–900 RPM,
   CHECK for smooth idle.
7. Engine Instruments.....CHECK
   all within normal flight limits

⬢ WARNING: If idle speed is too slow or the engine runs roughly, the cause must be determined and the condition corrected to avoid the potential for an in-flight stoppage.

NORMAL AND SOFT-FIELD TAKEOFF

1. Wing Flaps.....10°
2. Trim.....NEUTRAL
3. Carburetor Heat.....OFF
4. Fuel Boost Pump.....ON
5. Throttle.....SMOOTHLY ADVANCE to FULL
6. Elevator Control.....LIFT NOSE WHEEL at 40 KIAS. Apply rudder as necessary to maintain runway centerline. WAIT for aircraft to lift off at approximately 50 KIAS.
7. Climb Speed.....75 KIAS (flaps 10°)

At 500 feet or safe altitude:

8. Wing Flaps.....UP
9. Climb Speed.....85 KIAS
10. Fuel Boost Pump.....OFF

SHORT FIELD TAKEOFF

1. Wing Flaps.....10°
2. Trim.....NEUTRAL
3. Carburetor Heat.....OFF
4. Fuel Boost Pump.....ON
5. Brakes.....APPLY

6. Throttle.....SMOOTHLY APPLY TO FULL
7. Brakes.....RELEASE
8. Elevator Control.....SLIGHTLY TAIL LOW
9. Climb Speed.....70 KIAS until all obstacles are cleared

When at safe altitude:

10. Wing Flaps.....RETRACT SLOWLY
11. Airspeed.....85 KIAS
12. Fuel Boost Pump.....OFF

CROSSWIND TAKEOFF

1. Wing Flaps.....10°
2. Trim.....NEUTRAL
3. Carburetor Heat.....OFF
4. Fuel Boost Pump.....ON
5. Ailerons.....INTO WIND as necessary
6. Throttle.....SMOOTHLY ADVANCE to FULL
7. Rudder Control.....MAINTAIN runway centerline
8. Elevator Control.....LIFT NOSE WHEEL at 50-55 KIAS. Apply rudder as necessary to maintain runway centerline as aircraft leaves the ground.
9. Crab Angle.....ESTABLISH

10. Climb Speed……75 KIAS (flaps 10°)

At 500 feet AGL or safe altitude:

11. Wing Flaps.....UP
12. Fuel Boost Pump.....OFF
13. Climb Speed.....85 KIAS

ENROUTE CLIMB

1. Airspeed.....85 KIAS
2. Throttle.....OPEN
   as necessary to maintain desired climb rate

   - NOTE: Monitor cylinder head and oil temperatures to avoid exceeding their limits during extended climb periods in hot weather.

CRUISE

1. Throttle.....2750–2850 RPM
   - NOTE: Time above maximum continuous power of 2850 RPM is limited to 15 minutes.
2. Pitch Trim.....ADJUST for level flight

BEFORE LANDING/DESCENT

1. Seat Belts & Shoulder Harnesses.....ADJUST and LATCH
2. Fuel Boost Pump.....ON
3. Lights.....AS REQUIRED
4. Carburetor Heat.....AS REQUIRED

➢ NOTE: Carburetor heat should be applied below 1800 RPM or when required by ambient conditions.

➢ NOTE: Plan descent to keep cylinder head temperatures within limits. If CHTs drop below limits, decrease rate of descent and increase power up to 1800 RPM. Avoid high power settings when one or more CHT is below 167°F.

NORMAL TRAFFIC PATTERN AIRSPEEDS AND WING FLAP SETTINGS

Downwind.....75 KIAS, Flaps 10°

Base.....65 KIAS, Flaps 25°

Final.....52 KIAS, Flaps 25°

NORMAL LANDING

1. Final Approach Airspeed.....52 KIAS
2. Wing Flaps.....25°
3. Touchdown.....MAIN WHEELS FIRST
4. Nose Wheel.....LOWER GENTLY
5. Braking.....MINIMUM REQUIRED

SHORT FIELD LANDING

1. Airspeed.....52 KIAS
2. Wing Flaps.....25°
3. Power.....REDUCE
   to idle as obstacle is cleared
4. Touchdown.....MAIN WHEELS FIRST
5. Nose Wheel.....LOWER GENTLY
6. Brakes.....APPLY AS REQUIRED
7. Wing Flaps.....RETRACT
   when convenient for better braking

SOFT FIELD LANDING

1. Airspeed.....52 KIAS
2. Wing Flaps.....25°
3. Touchdown.....MAIN WHEELS FIRST
4. Nose Wheel.....KEEP ELEVATED
   as aircraft slows to safe taxi speed, then softly set onto landing surface.
5. Brakes.....MINIMUM REQUIRED

CROSSWIND LANDING

- NOTE: Max demonstrated crosswind component with full flaps is 15 knots.
- NOTE: Use minimum flap setting for available runway distance. Wing-low method of crosswind landing is recommended.

1. Airspeed.....55-60 KIAS
2. Wing Flaps.....MINIMUM REQUIRED
3. Touchdown.....UPWIND MAIN WHEEL FIRST
4. Ailerons.....INTO THE WIND
5. Rudder.....AS NECESSARY to maintain runway centerline
6. Nose Wheel.....LOWER GENTLY
7. Braking.....AS REQUIRED

BALKED LANDING

1. Throttle.....SMOOTHLY TO FULL OPEN
2. Rudder.....MAINTAIN RUNWAY CENTERLINE
3. Airspeed.....70 KIAS
4. Carb Heat.....OFF

5. Flaps.....10°

When clear of obstacles:

6. Wing Flaps.....UP

7. Climb Speed .....85 KIAS

AFTER LANDING

1. Wing Flaps.....UP

2. Fuel Boost Pump.....OFF

3. Carb Heat.....OFF

4. Lights.....AS REQUIRED

5. Trim.....NEUTRAL

ENGINE SHUTDOWN

1. Throttle.....IDLE

2. Electrical Switches.....OFF

3. Ignition .....OFF

4. Master Switch.....OFF

5. Fuel Selector.....OFF

6. Controls.....LOCK with Seatbelt

4.5 Detailed Normal Procedures

TAXIING

When taxiing, it is important that speed and use of brakes is kept to a minimum and that all controls be utilized (see Figure 7-2) to maintain directional control and balance. Taxiing over loose gravel should be done at low engine speed to avoid abrasion and stone damage to the propeller.

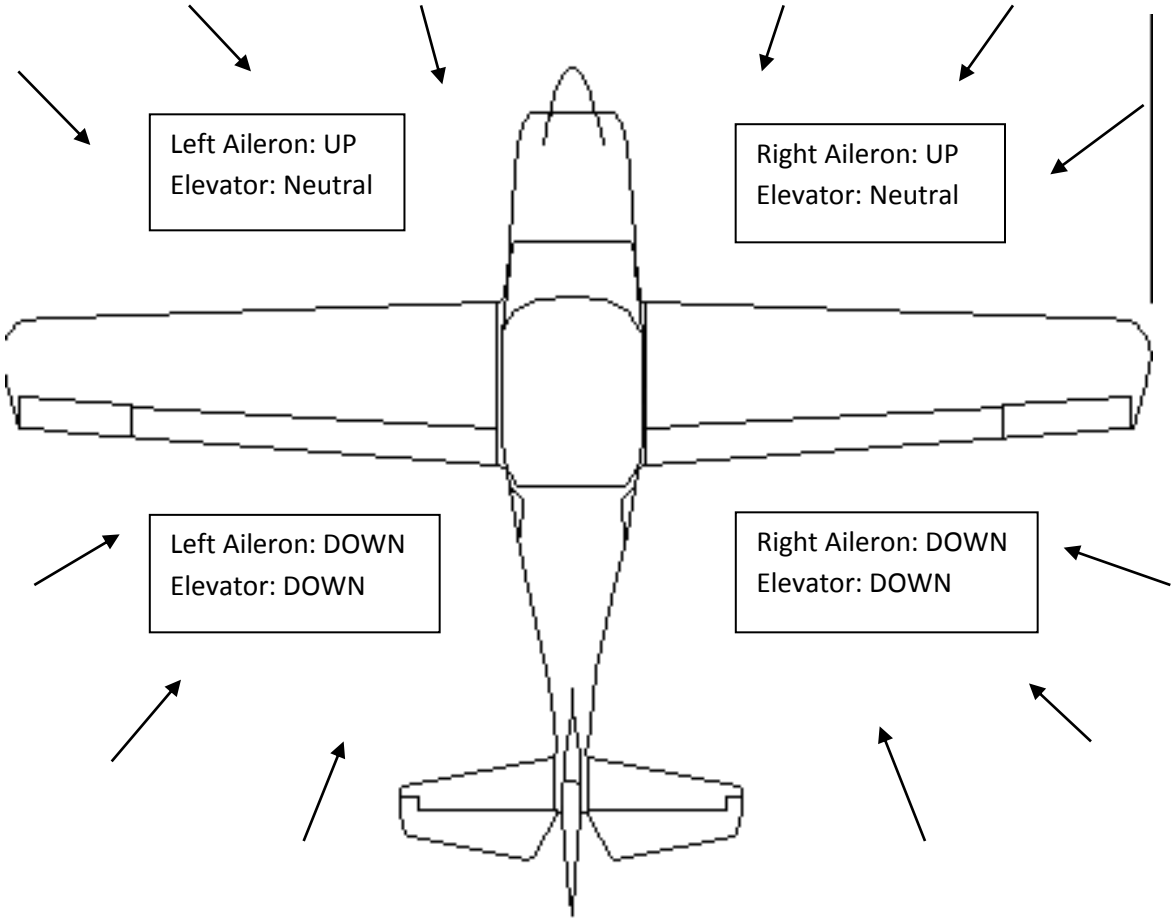


Figure 7-2: Wind Correction During Taxi

TAKEOFF WING FLAP SETTINGS

Takeoffs into strong crosswinds are normally performed with the minimum flap setting necessary for the field length to minimize the drift angle immediately after takeoff. With the ailerons partially deflected into the wind, the airplane is accelerated to a speed slightly higher than normal, and then pulled off positively and smoothly to prevent possible settling back to the runway while drifting. Once clear of the ground, make a coordinated turn into the wind to correct for drift.

CRUISE

Normal cruise is performed between 65% and 75% power. Continuous cruise should not exceed 2850 RPM for more than 15 minutes. Flights should be planned at 5.5 gallons per hour with 45 minutes reserve, with appropriate allowances for wind conditions which will assist in determining the most favorable altitude and power setting for a given trip.

LANDING

The limiting crosswind speed of 15 knots has been demonstrated with 25° of flap deflection. However, in strong crosswind conditions use the minimum flap consistent with the strip length available.

Use the Wing Low technique right through to touchdown and land on main gear first.

BALKED LANDING

In a balked landing (go-around) climb, the wing flap setting should be reduced to 10 degrees immediately after full power is applied and the aircraft has accelerated to a safe climb speed. Upon reaching a safe airspeed, the flaps should be slowly retracted to the full up position, while allowing the aircraft to accelerate to the best climb speed.

FUEL MANAGEMENT

Take Off and Landing

Always switch the Fuel Selector Valve to the fullest tank for takeoff and landing.

Cruise Flight

Pilots can manage fuel flow from the wing tanks to help trim the aircraft in flight.

To help balance the aircraft when there is only one pilot in the left seat, the pilot can use the left tank first to reduce weight on the left side. As fuel (weight) is removed from the left tank the aircraft may become better balanced.

Once the aircraft is balanced the pilot can then keep it relatively balanced by alternate feeding from each side during the remainder of the flight. Switch tanks every 30 minutes to maintain fuel balance.

NOISE ABATEMENT

Increased emphasis on improving the quality of our environment requires renewed effort on the part of all pilots to minimize the effect of airplane noise on the public.

As pilots, we can demonstrate our concern for environmental improvement by application of the following procedures:

1. At altitudes less than 2000 feet, avoid flying in close proximity to houses or over parks and recreational areas.
2. During approach to or departure from an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude near noise sensitive areas.

STARTING THE ENGINE FROM AN EXTERNAL POWER SOURCE

➢ NOTE: The Jabiru engine cannot be hand propped.

If the battery is not charged to a condition that will allow engine start, the engine may be started with external power.

- WARNING: Wheels must be chocked.
- WARNING: Ensure propeller is clear.
- WARNING: Ensure qualified person is in the operator seat.

1. Remove top cowl.
2. Inspect aircraft battery for signs of damage, leaks, corrosion, etc.
3. Connect electrical leads in the order that follows, ensuring that the leads are only touching the intended connection points:
    i. Positive (+) terminal on aircraft positive (+) battery terminal.
    ii. Positive (+) terminal on external power source.

iii. Negative (–) terminal on external power source.

iv. Grounding lug on aircraft firewall.

4. Start engine normally and check electrical instruments to see that charging system is functioning properly.
5. Point aircraft into the wind and run engine 5-10 minutes with all electrical equipment off except those items necessary to monitor the engine.

❖ CAUTION: Extended ground runs, particularly with the cowling off, may lead to elevated cylinder head temperatures. Monitor temps and and shut down engine if CHTs meet or exceed limits.

6. Stop engine.
7. Disconnect electrical leads in the exact reverse order of how they were connected.
8. Refit top cowl.
9. Fly the aircraft for at least an hour at normal cruise RPM. Leave non-essential electrical equipment (such as lights and transponder) turned off to allow the alternator to fully charge the battery.

Section 5
Performance

5.1 Takeoff and Landing Distance

Takeoff safety speed (1.3 VS1).....58 KIAS

Landing Approach speed (25° Flap).....52 KIAS

Sea-level takeoff distance to 50' with zero wind or slope, on a short dry grass surface.....900 ft

➢ NOTE: Sea-level take-off distance exceeds sea-level landing distance.

Takeoff and landing distance increase per 1000' of pressure altitude .....380 ft

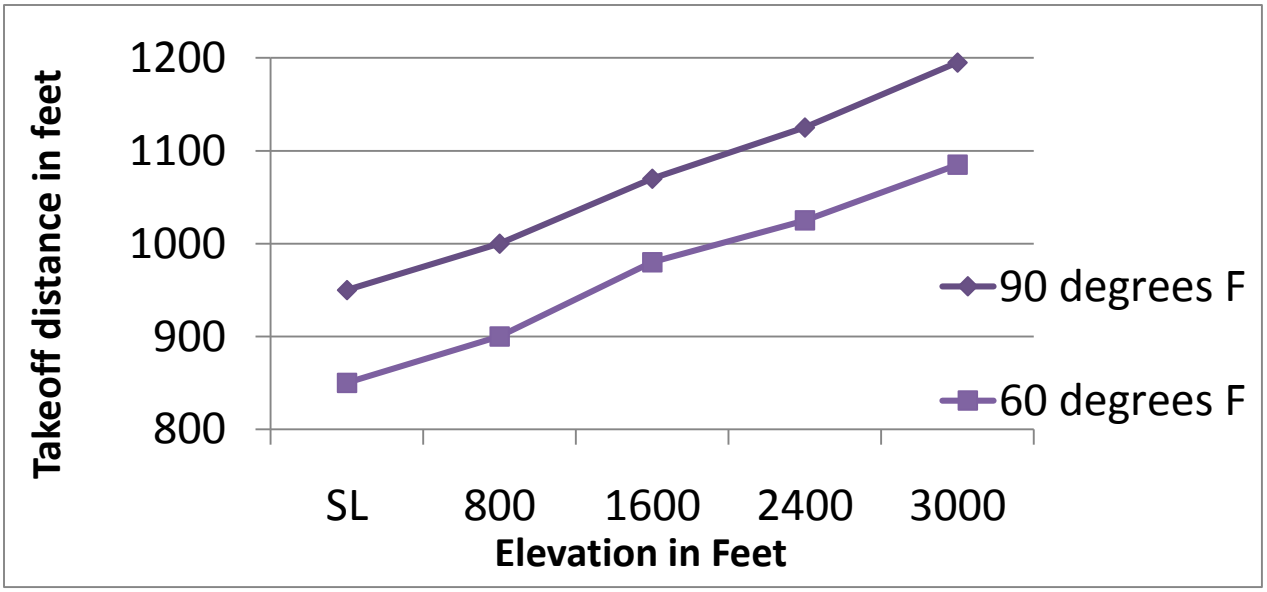
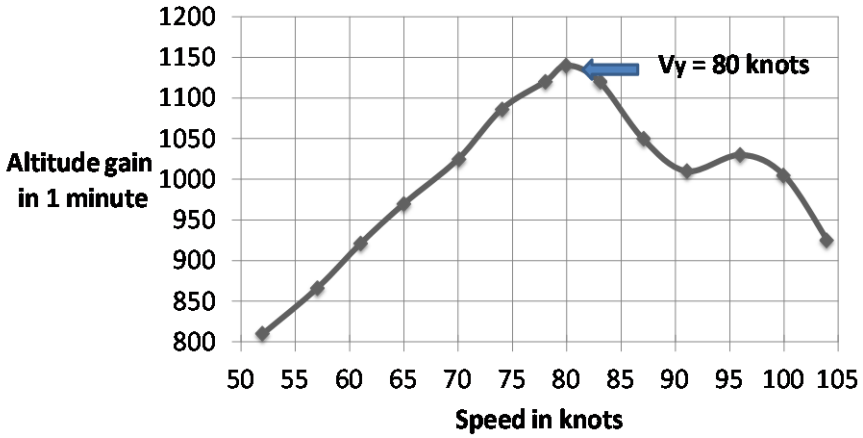


Figure 5-1: Takeoff Distance Chart

5.2 Rate of Climb

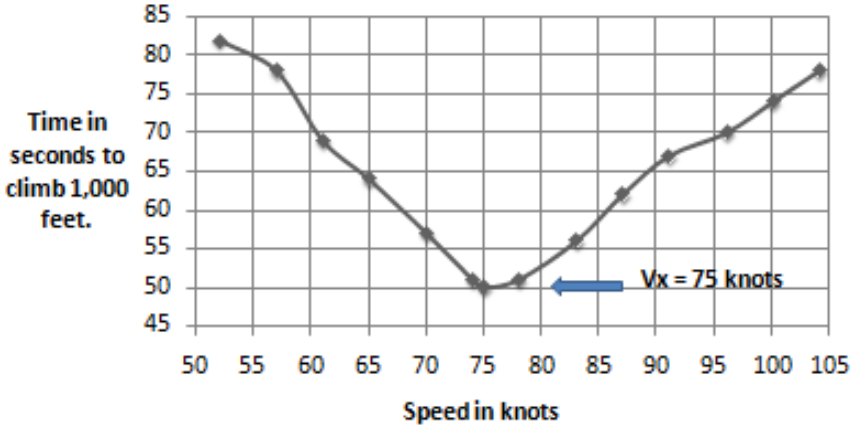
Sea Level, Standard Day, MGTOW.....1200 fpm

LS-1 Vy (Best Rate of Climb)



Notes: 24 September 2008, 4 degrees warmer than standard day. Climbs started at 2,000 feet and were timed for 1 minute. Aircraft weight 1300 lbs.

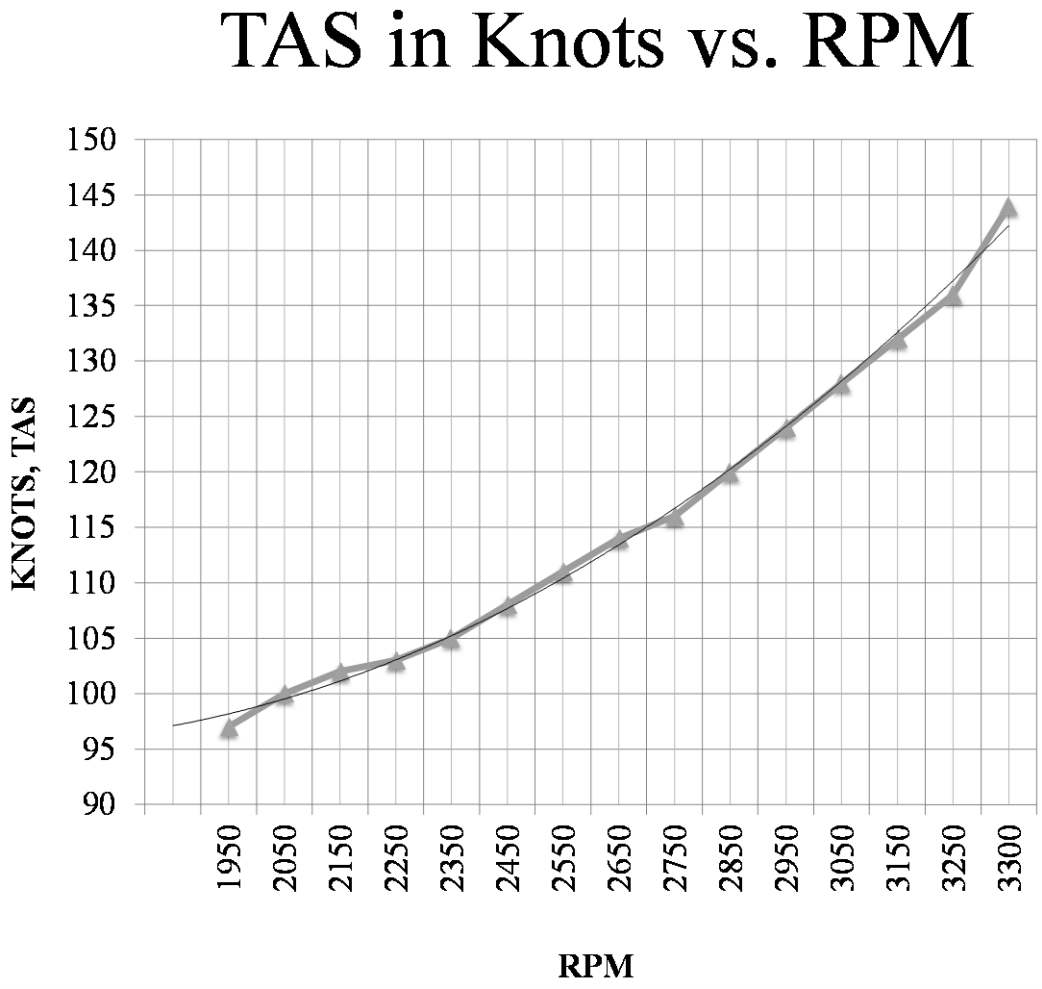
LS-1 Vx (Best Angle of Climb)



Notes: 22 September 2008, 4 degrees warmer than standard day. Climbs were between 2,000 and 3,000 feet. Aircraft weigh 1300 lbs.

5.3 Cruise Speed

Cruise speed at maximum continuous power (2850 RPM), sea level ..... 120 KCAS

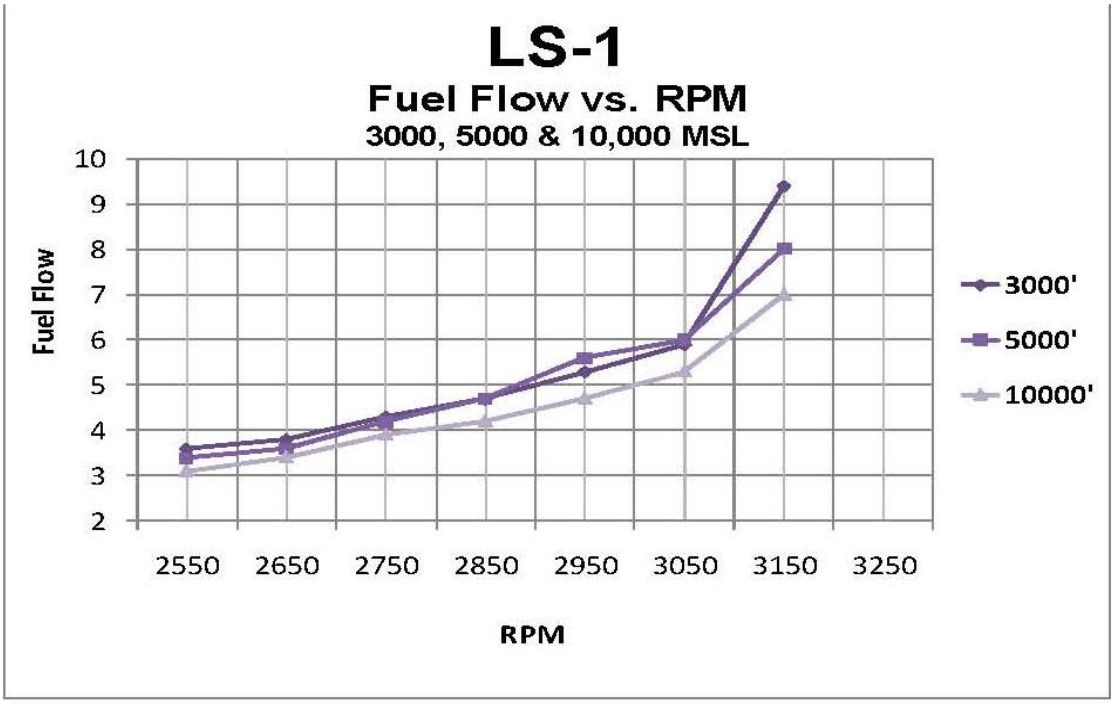


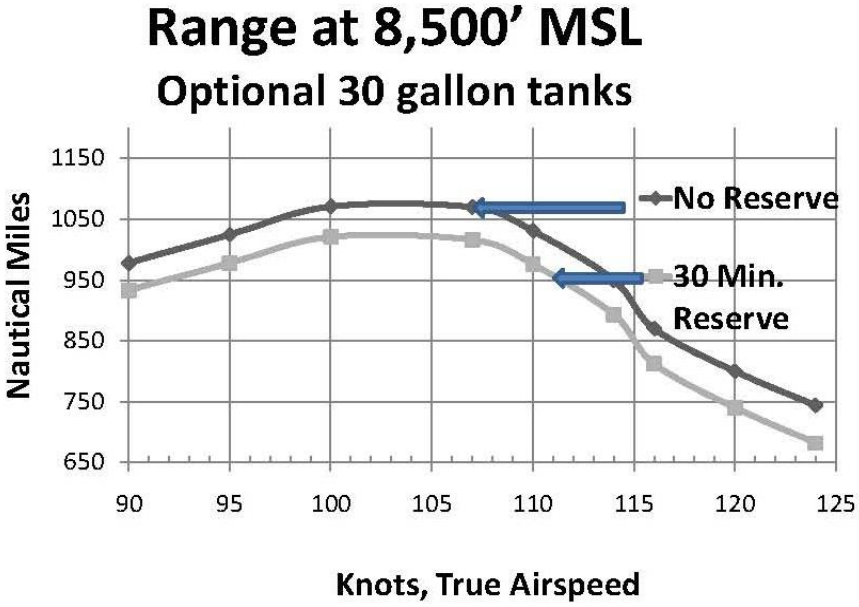
5.4 Cruise RPM

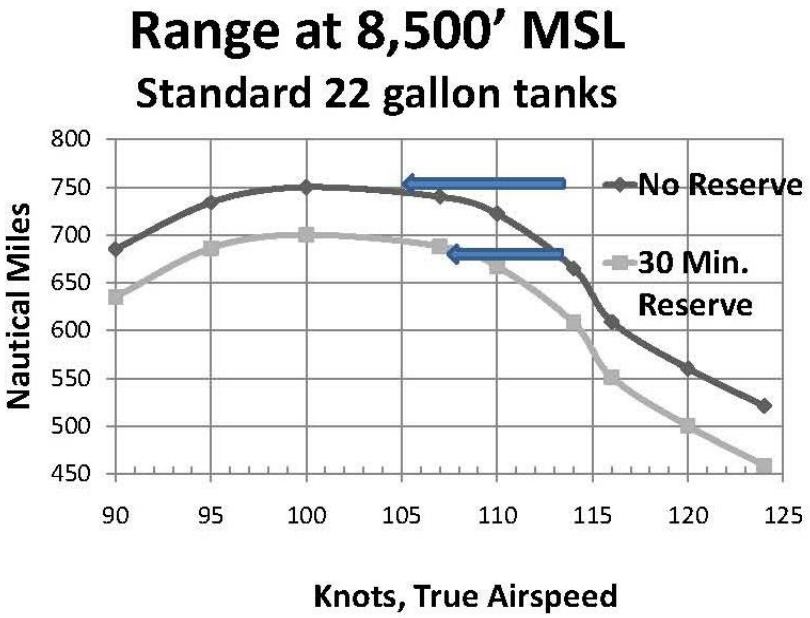
Maximum engine speed.....3300 RPM
Maximum continuous .....2850 RPM
Cruise range..... 2700 to 2850 RPM

5.5 Fuel Consumption

At 2850 rpm, sea level .....5.1 US Gallons/hr
At 2850 rpm, 8500 feet .....4.5 US Gallons/hr




Range at 8,500' MSL
Optional 30 gallon tanks
Nautical Miles
1150
1050
950
850
750
650
90
95
100
105
110
115
120
125
Knots, True Airspeed
No Reserve
30 Min.
Reserve


Range at 8,500' MSL
Standard 22 gallon tanks
Nautical Miles
800
750
700
650
600
550
500
450
90
95
100
105
110
115
120
125
Knots, True Airspeed
No Reserve
30 Min.
Reserve

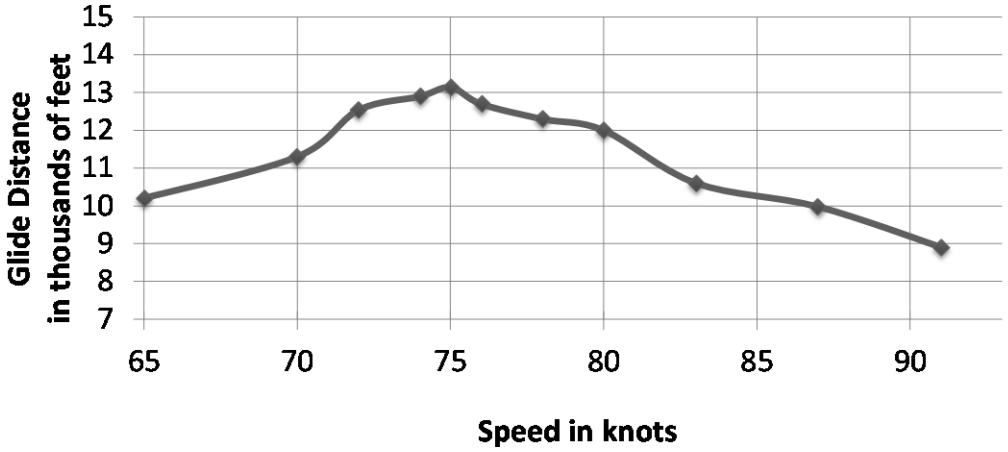
5.6 Maximum Glide

➢ NOTE: Best glide speed decreases approximately 1.5 percent or 1.125 knots for each 100 pounds below gross weight.

Lightning LS-1

Best Glide Speed for Distance –Flaps Up

Glide Distance: Horizontal distance traveled while descending 1,000 feet.

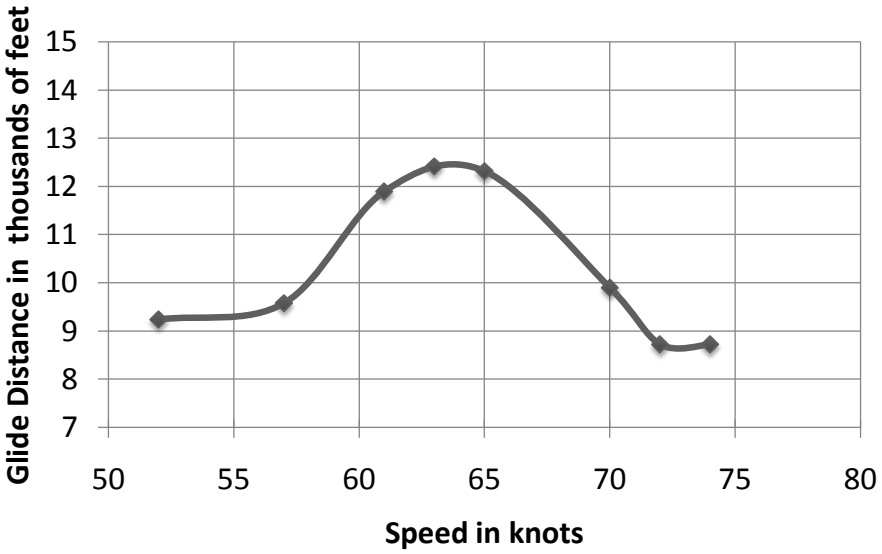


Note: 25 September 2008, 5 degrees warmer than standard day. Glides timed for 1 minute between 3,000 feet and 2,000 feet. Aircraft weigh 1300 lbs.

Lightning LS-1

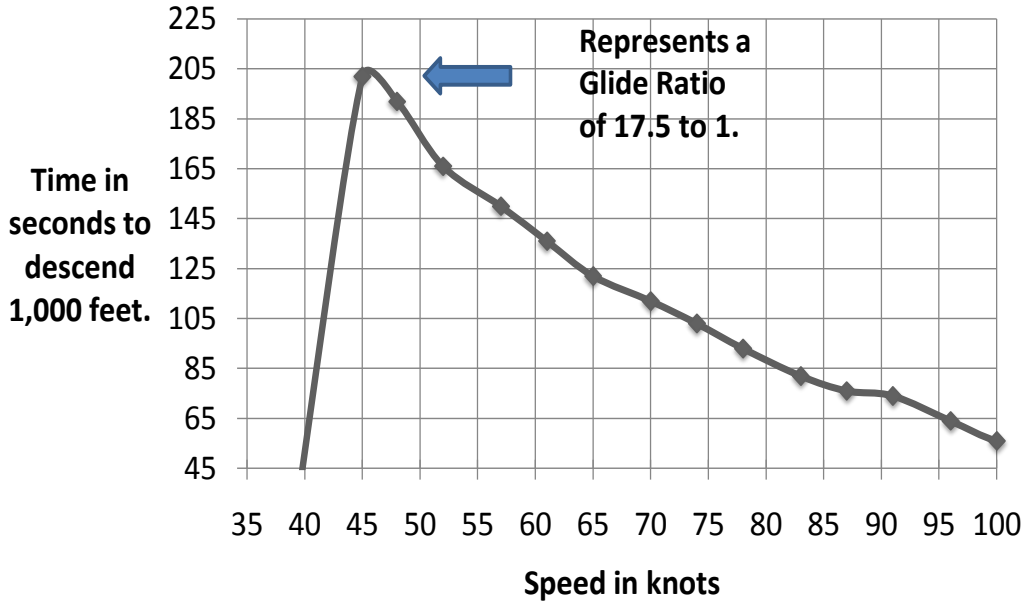
Best Glide Speed for Distance –Flaps 30 degrees

Glide Distance:
Horizontal distance traveled while descending 1,000 feet.



Note: 25 September 2008, 5 degrees warmer than standard day. Glides timed for 1 minute between 3,000 feet and 2,000 feet. Aircraft weight 1300 lbs.

LS-1 Minimum Sink



Note: 25 September 2008, 5 degrees warmer than standard day.
Glides timed for 1 minute between 3,000 feet and 2,000 feet.
Aircraft weight 1300 lbs.

Section 6
Weight & Balance and Installed Equipment

6.1 Introduction

This section contains basic weight and center of gravity information necessary to ensure correct loading of the aircraft. The N-number of the aircraft, as delivered, is listed in the footer of each page.

The airplane was weighed and basic empty weight determined at the factory, with all optional equipment installed, prior to initial delivery. Modifications, equipment changes, or loss of records may be cause for re-weighing to keep basic empty weight and CG information current. Refer to the Aircraft Maintenance Manual for the aircraft weighing procedure should it become necessary.

6.2 Center of Gravity (CG) Limits

Datum ..... Firewall

Forward Limit ..... 30.0 inches aft of datum
Up to and including 1320 lbs

Aft Limit ..... 34.0 inches aft of datum

6.3 Weight Limits

Maximum takeoff weight ..... 1320 lbs.

Maximum landing weight ..... 1320 lbs.

6.4 Baggage Zone Definition

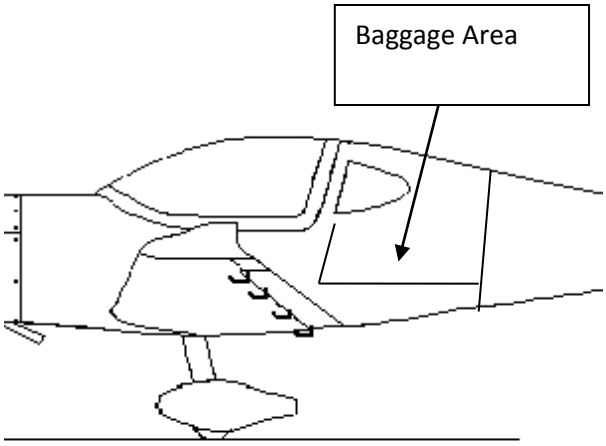


Figure 6-1: Baggage Zone Definition

6.5 Moment Arm Information

Cockpit Seat Station ..... 44.1 inches aft of datum

Fuel Station ..... 37.4 inches aft of datum

Baggage Area .....69.76 inches aft of datum

6.6 Weight and Balance Determination for Flight

It is the pilot's responsibility to ensure that the aircraft is properly loaded and operated within the prescribed weight and CG limits. The following steps should be used to calculate the airplane weight and CG before each flight using Table 6-1 as a guide and Table 6-2 for aircraft-specific data.

1. **Basic Empty Weight** – Enter the basic empty weight and moment from the Airplane Weight and Balance Record.
2. **Fuel Loading** – Enter the total combined weight and moment of usable fuel in the airplane.
3. **Pilot and Passenger** – Enter the total combined weight and moment of the pilot and passenger.
4. **Baggage** – Enter the total combined weight and moment of baggage loaded into Baggage Zones A, B, and C.
5. **Flight Condition** – Total the weights and moments and calculate the airplane center of gravity location by dividing the total moment by the total weight.

Lightning LS-1, N-----, s/n -----

Item	Description	Weight [LB]	Arm [IN]	Moment [LB-IN]
1	**Basic Empty Weight** *Ensure use of appropriate values from Airplane Weight and Balance Record.*	------	---	----
2	**Fuel Loading** *30 US gallons maximum at 6 lbs/gal*	180	37.4	3366
3	**Total Pilot and Passenger Weight**	---	44.1	---
4	**Baggage Weight** *50 lbs maximum*	---	69.76	---
5	**Total Weight and Moment** *CG=Total Moment/Total Weight*	1,320.0	**CG=** ---	---
Acceptable CG Location (arm) is between 30.0 and 34.0. Maximum allowable weight is 1320 lbs.				

Table 6-1: Sample Weight and Balance Loading Form

Lightning LS-1 N----, s/n -----

Item	Description	Weight [LB]	Arm [IN]	Moment [LB-IN]
1	**Basic Empty Weight** *Ensure use of appropriate values from Airplane Weight and Balance Record.*			
2	**Fuel Loading** *35.4 US gallons maximum at 6 lbs/gal*		37.4	
3	**Total Pilot and Passenger**		44.1	
4	**Baggage Zone A** *50 lbs maximum*		69.76	
5	**Total Weight and Moment** *CG=Total Moment/Total Weight*		**CG=**	
Acceptable CG Location (arm) is between 30.0 and 34.0. Maximum allowable takeoff weight is 1320 lbs.				

Table 6-2: Blank Weight and Balance Loading Form

6.7 Aircraft Equipment List

Each aircraft is issued a list of installed equipment which must be kept in this portion of the Pilot's Operating Handbook.

Each piece of equipment on the list that requires supplemental operation instructions is issued its own supplement, which must be contained in the Pilot's Operating Handbook if the equipment is installed in the aircraft. The Log of Supplements is found at the beginning of Section 9 of this handbook and controls the issuance and revisions of each supplement.

Information provided in equipment supplements adds to or replaces information from the basic instructions of aircraft operations for aforementioned parts only. Limitations, procedures, and information not covered in equipment supplements are covered elsewhere in the POH.

Installed Equipment- Lightning LS-1

Registration	N----
Airframe Serial No.	----
Airworthiness Date of Issue	--/--/----

S=Standard Equipment O= Optional Equipment

X= Installed in This Aircraft

INSTRUMENTS & AVIONICS		
X	S	Single GRT Sport 8.4" EFIS flight display
	O	Dual GRT Sport 8.4" EFIS displays
	O	Garmin GDU375 multifunction display
	O	Dynon Skyview System
X	S	2 ¼" Analog Airspeed Indicator
X	S	EIS 6000 Engine Monitor
X	S	Garmin SL40 Radio
	O	Garmin SL30 Nav/Com
	O	Garmin GTX327 Mode C Transponder
	O	Garmin GTX330 Mode S Transponder
X	S	PM1000II Intercom
	O	PM3000 Intercom
X	O	TruTrak Digiflight II VS Autopilot
	O	GRT Autopilot
	O	Dynon Autopilot

AIRFRAME OPTIONS		
X	S	Jabiru 3300A Aircraft Engine s/n -----
X	S	Sensenich Fiberglass Sheathed Wood Propeller
	O	Sensenich Carbon Ground Adjustable Propeller
X	S	Kannad 406 MHz ELT with panel remote
X	S	Vertical Card Compass
X	S	12V Charging Outlet
X	S	Music Input Jack
x	S	Hobbs meter
X	S	AeroLED wingtip Nav/Strobe light package
X	S	Wing-mounted LED landing lights
	O	Tanis Engine Heater
X	S	Cloth Interior
	O	Vinyl Interior
	O	Leather Interior
X	S	Wheel Pants
X	S	Clear Canopy
	O	Tinted Canopy
	O	Small Opening Window in Canopy
	O	Cockpit Access Steps

PAINT & FINISHING		
Paint System.....Matrix		
Color	**Paint Code**	**Color Name**
Base Color	MT-84	Matrix Base White
Trim Color 1	--	--
Trim Color 2	--	--
Trim Color 3	--	--
Clear Coat	--	--

Section 7
Description of Airplane & Systems

7.1 General Description

The Lightning LS-1 is an all-composite, two-place, single engine, low-wing monoplane equipped with fixed landing gear and a fixed-pitch propeller. It was built and certified under the FAA-accepted ASTM standards for Light-Sport Aircraft airworthiness requirements.

The fuselage is a semi-monocoque fiberglass structure with carbon fiber reinforcement in the wing root area. The wings are fiberglass composite with an aircraft-grade spruce spar core wrapped in fiberglass, integral fiberglass fuel tanks and winglets. The wing spars overlap and are joined inside a welded steel spar box, which also functions as the main landing gear mount. The control surfaces are fiberglass composite.

7.2 Flight & Ground Controls

PRIMARY FLIGHT CONTROLS

The primary flight control system consists of conventional aileron, elevator and rudder control surfaces. The elevator and ailerons are manually actuated with push-pull control tubes connected to the control stick assembly. The rudder is driven by conventional pedals with tensioned cables and pulleys.

TRIM SYSTEM

The pitch trim is electrically-driven and actuated by a rocker switch on the instrument panel. There is no provision for rudder or aileron trim.

WING FLAP SYSTEM

The wing flaps are electrically actuated by a linear actuator mounted in the spar box area. The wing flap control switch is a three-position momentary switch located on the instrument panel above the throttle control. Pushing the switch upward raises the flaps and pushing the switch downward lowers the flaps.

GROUND CONTROLS

The nose wheel is free castering to approximately 30 degrees each direction. Toe brakes are used to activate each main disc brake separately to assist in steering. See the Flight Training Supplement for more information on proper operation of the flight and ground controls.

7.3 Instrument Panel

The LS-1 has several options for instrument panel layout and equipment. All panel layouts focus on ease of pilot operation, with the primary flight instruments displayed in front of the left seat occupant. The throttle, carburetor heat, choke, and cabin heat controls are in the center of the panel. Switches are on a panel to the left side of the primary EFIS screen. The circuit breakers are located on the right side of the right EFIS screen.

In GRT systems, the Engine Information System (EIS) unit is blind-mounted under the left side of the instrument panel on a flip-down hinged panel. All engine information is sensed by the EIS and displayed on the primary EFIS screen. In Dynon systems, all engine information is sensed by the EMS module and displayed on the EFIS.

7.4 Flight Instruments

Please refer to the Supplements section of this POH for operating instructions for the flight instruments and avionics installed in this aircraft.

PITOT/STATIC SYSTEM

The pitot/static mast is mounted under the right wing and is not heated. The static port is located on the lower tube. It is a hole drilled through the tube behind a cap that shelters the port from ram air pressure. The pitot port is the upper tube. The pitot/static lines run through the right wing root and under the instrument panel to provide the electronic flight display equipment and autopilot with raw pitot/static data.

AIRSPEED CALIBRATION

Indicated airspeed differs from calibrated airspeed due to instrument and position error in the pitot static system. This position error affects indicated airspeeds at slower airspeeds

KIAS	KCAS		
	Flaps UP	Flaps Take-off	Flaps Landing
42			
45			
48			
50			
56			
57			
63			
73			
85			
94			
106			
113			
125			
135			

7.5 Engine Systems

ENGINE INFORMATION

Manufacturer.....Jabiru Aircraft Pty Ltd
Model..... 3300A

Configuration..... Horizontally-Opposed
Drive.....Direct-Drive

Cooling.....Air-Cooled

Ignition.....Dual Transistorized Magneto

Carburetor.....BING altitude-compensating

Power Rating ..... 107 hp @ 2750 RPM
..... 120 hp @ 3300 RPM

Power Loading .....11 lbs / hp

ENGINE CONTROLS

The engine controls consist of the throttle, magneto/starter key switch, choke, and carburetor heat. See Section 4, Normal Procedures, and the Flight Training Supplement for detailed instructions on using the engine controls.

ENGINE INSTRUMENTS

All engine data is sensed and processed by an electronic engine monitor (either Grand Rapids or Dynon) and displayed on the primary or secondary EFIS system as selected by the pilot. Engine warnings display as prominent yellow or red alerts on the primary EFIS screen.

ENGINE OIL SYSTEM

Oil System.....Wet Sump

Max Normal Oil Consumption .....1 qt/10 hours

Oil Sump Capacity.....3.7 US Quarts

See Section 8 of this handbook for approved oil grades and checking/servicing information.

7.6 Propeller

Manufacturer .....Sensenich Wood Propeller Company

Type .....Fixed Pitch Wood Model W60ZK-57G

Diameter .....60 inches

Pitch .....57 inches

7.7 Electrical System

Battery.....12V sealed drycell

Reserve capacity.....approx. 1 hour @ 12 amps

Alternator.....20-amp A/C, permanent-magnet

Voltage Regulator.....External regulator-rectifyer

Circuit Breakers.....Pull-Type

Switches.....Breaker-Type

7.8 Fuel System

The LS-1 fuel system is comprised of a 15 gallon tank in each wing. There is an engine-driven fuel pump that runs continuously during engine operation to draw fuel from the selected fuel tank. An electric boost pump is installed as a backup to the mechanical pump and to facilitate refilling of the carburetor bowl after periods of inactivity.

Refer to Section 2.6 of this handbook for fuel quantities and approved fuel grades.

FUEL SELECTOR VALVE

One fuel selector valve is located on the center console below the engine controls. It has three

settings: LEFT, RIGHT, and OFF. LEFT draws fuel from the left wing tank, RIGHT draws fuel from the right wing tank, and OFF shuts off the fuel supply to the engine at the location of the selector valve.

FUEL SUMPS

The aircraft has two fuel sumps with quick-drain valves that must be checked during preflight operations. The wing sump quick-drain valves are located just outboard of the fuselage on the underside of each wing.

CARBURETOR

Manufacturer.....Bing Agency

Model.....Type 94/40 pressure-compensating

Each LS-1 carburetor is set up for proper jetting in an average climate before leaving the factory. Operation in extreme climates or out of high mountain airports may require an adjustment to carburetor jetting for optimum engine performance. Consult the LS-1 Maintenance Manual for more information on adjusting the jetting.

CARBURETOR HEAT SYSTEM

Air temperatures inside the carburetor drop during normal operation due to vaporization of the fuel and acceleration of air through the carburetor. This cooling can result in surface temperatures as much as 30°F below the temperature of the ambient air. As a result, carburetor ice may form on the throttle plate during periods of operation at low power settings. Carburetor icing can obstruct airflow and result in engine stoppage.

The first indication of icing is an RPM drop or reluctance of the engine to come back to full power after prolonged period of reduced power. Progressive icing will cause obstruction of the carburetor, leading to enrichened mixture and a rough running engine.

The carb heat system directs air from the outer surface of the muffler into the engine induction system for the prevention and elimination of carburetor ice. It should be used at power settings less than 1800 rpm. If ice is suspected, pull carb heat to full OPEN. "Pump" the throttle open and closed several times to break the ice free from the throttle plate. Leave carb heat on for at least one minute to melt all residual ice from the induction system.

Carburetor heat may be safely used on the ground but is not to be used during takeoff or climb. In case of a go-around, turn the carburetor heat OFF as soon as safely possible.

❖ CAUTION: Prolonged use of carburetor heat with more than 80% power applied increases the likelihood for detonation.

CARBURETOR HEAT CHECK

Carburetor icing can occur on the ground, particularly when the aircraft and engine have become damp overnight.

Because the carburetor automatically adjusts for changes in air density, there should be VERY LITTLE, if any, RPM drop during the run-up carburetor heat check. If there is a noticeable drop in RPM when heat is applied, carburetor ice may have formed during taxi and should be burned off prior to takeoff. Prior to lining up on the runway close the throttle completely; if a low idle rpm or engine stoppage occurs, ice may be present. Burn it off with one minute of heat and then test again prior to take off.

THIS PAGE INTENTIONALLY BLANK

Section 8
Ground Handling and Servicing

8.1 General

This aircraft must be maintained in accordance with applicable Federal Aviation Regulations. This includes an annual inspection, 100-hour inspections for commercial operators, and 50-hour service and inspections as required by the manufacturer.

Engine and airframe maintenance must be carried out by approved maintenance personnel per the Arion Lightning LS-1 Aircraft Maintenance Manual and the most current revisions of applicable Jabiru 3300 (Hydraulic Lifters) engine manuals.

The most current engine manuals are available from www.jabiru.net.au. The Aircraft Service Manual may be downloaded from the Arion Aircraft website: http://www.flylightning.net.

8.2 Ground Handling & Tie-Down

GROUND HANDLING & TOWING

Only manual ground handling is recommended. Hand pressure placed down onto the root of the vertical stabilizer will lift the nose wheel off of the ground and allow the handler to maneuver the aircraft. Approved push pull points are limited to the following (see Figure 8-1):

1. Propeller blade root – NOT PROPELLER TIP
    a. Check that ignition switch is off and key is removed.
    a. Place hand no more than 3" away from spinner.
2. Front of horizontal stabilizer, near fuselage
3. Front of vertical stabilizer at the base
4. Inboard wing area

❖ CAUTION: Do not push on control surfaces, including the rudder or elevator.

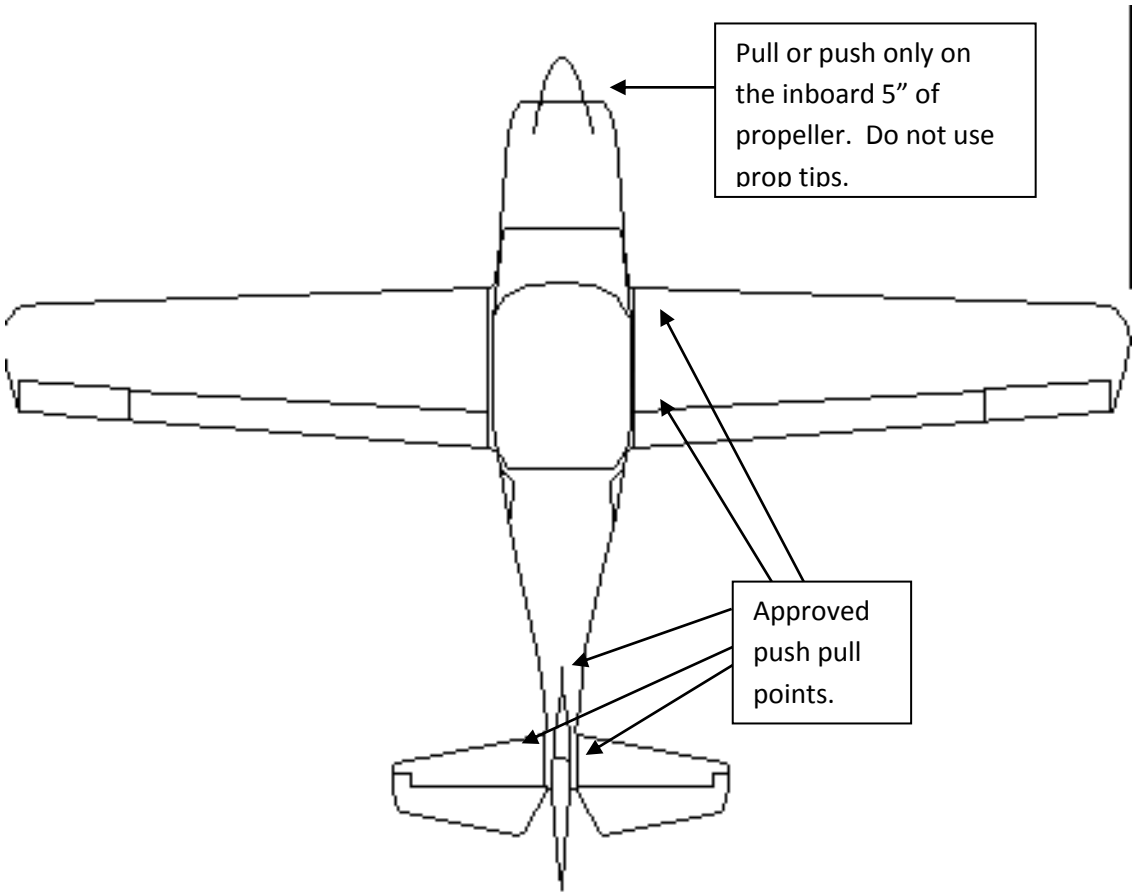


Figure 8-1: Approved Push-Pull Points

TIE-DOWN AND STORAGE

If the aircraft is not to be flown or run for a period of 30 days or more, refer to the storage instructions in the aircraft maintenance manual to protect the aircraft against engine corrosion, fuel deterioration, pest infestation, etc. Aircraft to be parked for 30 days or more should have their fuel tanks either completely drained or filled with 100LL. Storage for any length of time with auto fuel in the tanks is not recommended because fuel degradation may result, leading to detonation and possible engine damage.

Arion Aircraft recommends use of a canopy cover during periods of outdoor storage. A good quality cover protects the canopy, shields the interior from UV damage and helps keep water out of the aircraft. Cotton-lined canvas covers are available through Arion Aircraft.

➢ NOTE: Do not use an unlined plain canvas cover or tarp, as these may scratch the canopy.

When parking the aircraft outdoors:

1. Always remember to close both cabin air vents to prevent rain and wildlife from getting inside the cabin.
2. Always place the propeller in the horizontal position to avoid uneven accumulation of moisture in the blades.
3. Consider locking the canopy and fuel caps for security.
4. Set the parking brake to help keep the airplane from rolling against the tiedown ropes in high winds.

Tie-down configuration is shown in Figure 8-2. Tie down the aircraft by looping rope or strap to outboard flap hinge on each side, (refer to Figure 8-2, top). Tie out at 45 degrees away from aircraft.

Tie down the rear of the aircraft by looping the rope through the lower rudder hinge (see Figure 8-2, bottom). Slack should be left in all tie-down ropes to allow for movement of the aircraft.

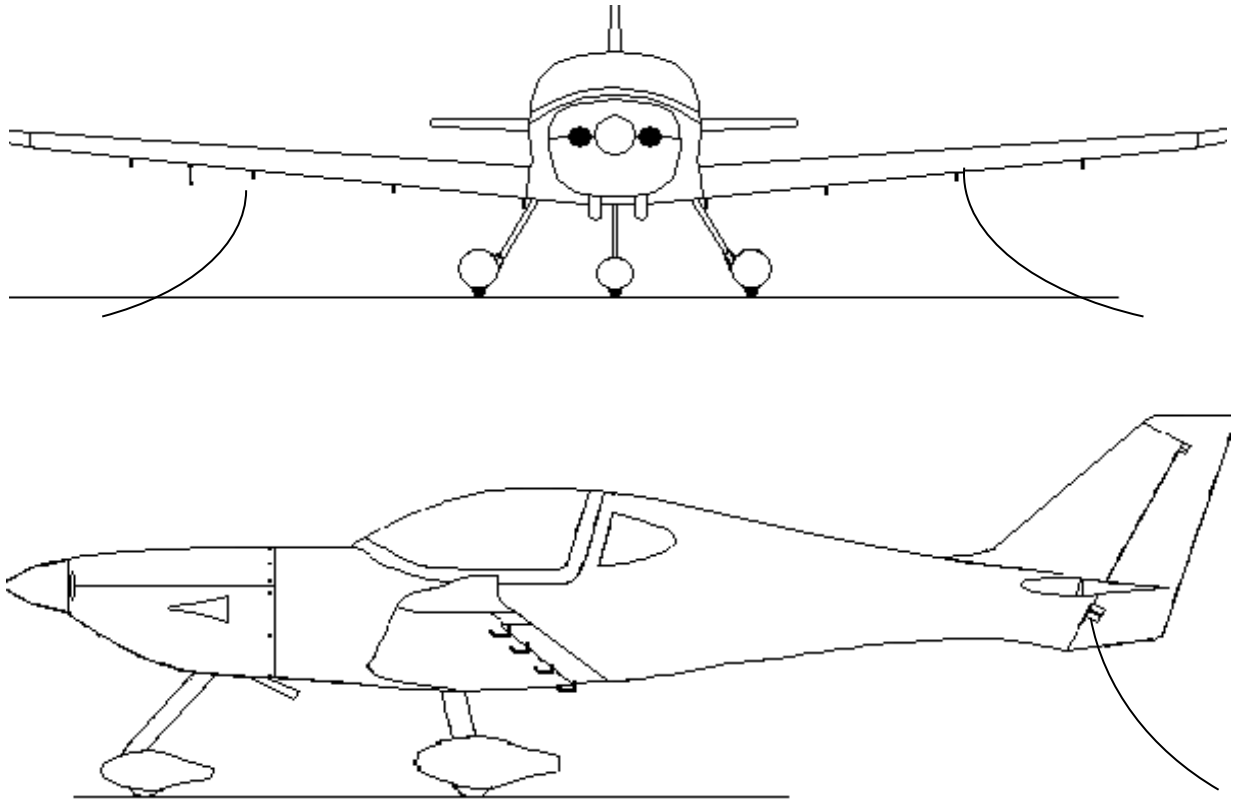


Figure 8-2: Tie-down configuration. Notice tie-down angle away from aircraft and slack left in tie-down ropes.

8.3 Servicing Fuel and Engine Oil

GUIDELINES FOR SAFE FUELING

1. Fuel quantity must be visually checked before each flight.
2. A fuel sample must be drawn from each main tank before each flight and after each refueling to check for water or sediment in the fuel system.
3. Aircraft must be grounded with an approved grounding cable during fueling. Grounding cable should be clipped onto exhaust pipe.
4. Chock wheels or set parking brake (if equipped) before fueling.

❖ CAUTION: Do not lean the fuel nozzle against the edge of the fuel filler opening. The weight of the hose and nozzle prying against the edge of the fuel collar will cause damage to the collar and wing skin.

❖ CAUTION: Do not allow the fuel nozzle to impact the bottom of the tank, as fuel tank damage may occur.

⬢ WARNING: Always check for fuel contamination. Contamination is a major cause of engine failure. Once fuel is dispensed into a container, contamination hazards exist. Use a clean, safety approved storage container. Do not overfill the container—allow for expansion.

SERVICING ENGINE OIL

Engine oil quantity must be checked before each flight using the following procedure:

1. Using a Phillips screwdriver, unlock (1/4 turn) camlocks and flip open oil door in top of cowl.
2. Unscrew oil filler cap.
3. Remove dipstick and wipe clean, if necessary, with a clean rag.
4. Reinsert dipstick and screw filler cap down until snug, but not tight.
5. Unscrew filler cap and remove dipstick again, noting engine oil level.

6. Add the appropriate amount and grade of engine oil using a clean funnel.

7. Reinsert dipstick and turn cap until snug. DO NOT over-tighten.

8. Clean up any spilled oil and close the oil door.

➢ NOTE: Normal cold engine oil level is no more than halfway between dipstick hash marks. Normal hot engine oil level is 1/8" up from bottom of dipstick.

➢ NOTE: It takes approx. ½ quart to raise cold oil level from bottom of dipstick to lower hash mark. It takes ¾ quart to raise oil level from lower hash mark to upper (FULL) hash mark. Total crankcase volume is 3.7 quarts.

❖ CAUTION: DO NOT overfill. Oil levels above the FULL mark may cause elevated oil temperature and reduced oil pressure.

OIL RECOVERY SYSTEM

A vent line runs from the filler neck on the crankcase to the Oil Recovery Bottle, which is mounted on the engine mount. This bottle collects excess oil and condensation. It should be emptied periodically, about every 50 hours or when full.

8.4 Approved Fuel and Oil Grades

APPROVED FUELS

100LL grade aviation gasoline is recommended and approved for all operations.

- WARNING: Use of automotive fuel is discouraged because it may contain unknown amounts of acetone, MEK, and other chemicals which will harm the fuel tank sealant.

APPROVED ENGINE OIL

Oils developed and branded for use in air-cooled aircraft piston engines which conform to the requirements of SAE J-1899 (formerly MIL-L-22851D), Textron Lycoming Specification No. 301F, or Teledyne-Continental Motors MHS-24B are approved.

Oils meeting these requirements include, but are not limited to, AeroShell W100 and AeroShell part synthetic 15W-50, with **Aeroshell 15W-50 being the preferred oil.** In cold climates, AeroShell part synthetic 15W-50 (or equivalent) is recommended.

❖ CAUTION: DO NOT USE oil or additives containing *LinKite*, as this will damage the engine and void the engine warranty.

➢ NOTE: Oil additives of any type are NOT recommended for use in Jabiru aircraft engines.

8.5 Basic Undercarriage Maintenance

TIRE INFLATION PRESSURES

Standard Mains.....25-30 psi

Nose.....25-30 psi

BRAKE SYSTEM FLUID GRADE

Brake fluid grade.....MIL 5606 hydraulic fluid

8.6 Propeller Care And Servicing

Sensenich wood and glass-covered propellers will give years of reliable service if properly cared for. Tips for long propeller life include:

1. Always store your aircraft with the propeller in the horizontal position to avoid uneven accumulation of moisture in the blades.

2. Never perform run-ups in areas with loose gravel, which may kick up and damage the blades.

3. Avoid flight in heavy rain, which may nick the paint surface of the blade leading edge.

The hub of a wood propeller will naturally swell and shrink slightly due to seasonal changes, moisture accumulation and dehydration. Because of this, mounting bolts of wood propellers must be periodically checked for correct tension. This check must be done during each 50-hour service or after periods of prolonged significant climate change. Refer to the Aircraft Maintenance Manual for detailed instructions for checking propeller bolt tension. Failure to check propeller bolt tension may result in

elongation of propeller hub bolt holes and subsequent propeller failure.

Nicks and gouges in a wood propeller must be repaired according to Sensenich Wood Propeller Company repair procedures.

8.7 Cleaning and Care

EXTERIOR

The exterior finish used on Lightning aircraft is a two-part automotive-type paint system that utilizes a base and clear-coat. For optimum performance and aesthetics, the exterior surfaces of the aircraft should be kept clean and free of bugs and grease.

The painted surfaces and canopies of Arion Lightning factory demonstrator airplanes are routinely cleaned and polished with Turtle Wax® Express Shine, a spray-type cleaner that leaves a thin protective coating. This coating aids in removal of dirt and bugs if kept up regularly. It is applied directly to the surface with the spray bottle and simply wiped dry with a clean microfiber cloth. When cleaning windows, always use a new, clean cloth and avoid swirling motions.

Heavy accumulation of bugs and grease on painted surfaces should be removed with a light mixture of soap and water and then rinsed. The TurtleWax® may then be applied for a smooth protective shine.

Specialty plastic cleaners such as Plexus® will also work on the canopy and windows. If tape or sticker residue gets on the windows, GooGone® citrus stain remover dabbed onto a soft microfiber cloth will remove it without harming the plastic.

❖ CAUTION: Use only cleansers approved for acrylic-based plastics on and near the windows.

INTERIOR SURFACES AND UPHOLSTERY

The interior may be cleaned using standard automotive upholstery cleaners made for the particular type of covering.

EFIS screens and instruments may be cleaned using a soft cloth and a cleanser made for LCD screens.

❖ CAUTION: Do not use silicone-based cleansers, as these may soak through the carpet and into the fiberglass, affecting future reparability of the components.

8.8 Removal Of Cowling & Wheel Pants

ENGINE COWL REMOVAL AND REINSTALLATION

To access the engine compartment, the upper and lower engine cowlings are removable.

The Upper Cowl is held in place with Camlock fasteners. The Lower Cowl is held to the forward fuselage with a series of machine screws and washers along the trailing edge.

TO REMOVE UPPER COWL:

1. Using a Phillips screwdriver, press down on each Camlock fastener and twist counterclockwise ¼ turn. The heads will pop up when loosened.
2. Lift the cowl off the top of the nose. It is lightweight; make sure to place it in an area where it cannot be damaged by wind or prop blast.

TO REINSTALL UPPER COWL:

1. The lower cowl must be installed. Gently place upper cowl on top of the lower cowl. Take care not to let the forward edge touch the spinner; it will scratch the polished metal.

2. Reinstall the Camlocks. Hint: The Camlocks on the top rear edge of the cowl may be different lengths, depending on the thickness of the material they anchor into. If a Camlock does not latch into place, try it in one of the other holes.

TO REMOVE LOWER COWL:

1. Remove upper cowl as described above.
2. Make sure the ignition is OFF and the key is out of the switch, then place the propeller in the horizontal position.
3. Loosen the hose clamps around the SCAT hoses where they connect to the cowl, and gently pull them away from the NACA ducts.
4. Remove machine screws in the trailing edge of the cowl, leaving the top screw on each side loosely in place.
5. Find a helper to catch the nose of the cowl; then remove the top screw on each side. Guide the cowl over the nose gear and set it aside, preferably upside-down to avoid scratching the paint.

TO REINSTALL LOWER COWL:

1. Find a helper to lift the cowl into position. Avoid hitting the edge of the cowl on the spinner, as it will scratch the polished metal.
2. Install each of the machine screws and washers loosely, from top to bottom.
3. Reinstall the SCAT hoses onto the NACA ducts.
4. Make sure ALL tools and hardware are out of the engine compartment, then reinstall the upper cowl. When satisfied with the fit and alignment of both cowls, finish tightening the machine screws.

REMOVAL AND INSTALLATION OF WHEEL PANTS

Removal of wheel pants is recommended for transition training and for operations on snowy, slushy or grass surfaces.

Main Wheel Pants: Remove machine screws that attach fiberglass pant to wheel pant brackets.

Nose Wheel Pant: Remove machine screws that attach the front and rear halves of the wheel pant.

Reinstall screws to install wheel pants.

8.9 Trickle Charger

Each Lightning LS-1 is delivered from the factory with a trickle charger. The pigtail for the charger is accessible through the oil door in the top of the cowling and connects to the aircraft battery.

The charger will charge the battery only when necessary, shutting off when the battery is fully charged.

Section 9
Supplements

9.1 Introduction

This section contains instructions for equipment installed in the aircraft including the flight display screens, engine information system, and autopilot. Supplements and their revisions are controlled by the Supplement Log on page 9-3.

9.2 Improvements And Corrections

Please report any errors or omissions in this manual to the aircraft manufacturer.

9.3 Continued Operational Safety

Please report all incidents or observations that might affect safety of flight or continued airworthiness of the LS-1 fleet on the Malfunction or Defect Report, found in the Aircraft Maintenance Manual. The input of owners, operators and mechanics in the field is essential to maintaining the Lightning LS-1 fleet in an airworthy condition for years to come.

9.4 Owner Change Of Address Notice

It is mandatory for LS-1 owners to update their contact information with Arion Aircraft to ensure timely delivery of safety notices and other important information. Failure to do so may affect airworthiness of your aircraft.

9.5 Log of Supplements

The Log of Supplements lists the title, revision, and effective date of all of the supplements available for the aircraft. Each supplement required in the aircraft POH is marked with an X in this table under the N number. Supplements must be updated in this manual if they are revised or if the aircraft is upgraded after initial delivery.

LOG OF SUPPLEMENTS

No.	Title	Revision	Date	N----
FTS	Flight Training	2	12/1/11	X
S1	GRT EIS 6000	2	12/1/11	
S2	PM1000II Intercom	2	2/15/10	
S2a	PM3000 Intercom	2	12/1/11	
S3	Garmin SL40	2	2/15/10	
S4	Garmin SL30	2	2/15/10	
S5	Garmin GTX327	2	2/15/10	
S6	Garmin GTX330	2	2/15/10	
S7	GRT Sport EFIS	2	2/15/10	
S9	Kannad 406 MHz ELT	2	2/15/10	
S11	TruTrak Digiflight IIVS Autopilot	2	12/1/11	
S12	WxWorx XM Weather	2	2/15/10	
S14	Garmin GDU375 Map Display	2	12/1/11	
S16	Tanis Engine Heater	2	2/15/10	
S17	Dynon Skyview system	2	1/16/11	
S19	AmeriKing ELT	2	1/16/11	

No.	Title	Revision	Date	

Lightning LS-1

Flight Training Supplement

INTRODUCTION

This flight training supplement is intended to provide information regarding features, performance, and procedures that are unique to this aircraft model. It does not provide information or details about subject matter that is considered common knowledge or part of a standard flight training regimen. It also does not repeat information that is already stated elsewhere in the Pilot's Operating Handbook.

This supplement is not intended to replace or substitute for proper pilot training, transition training, or familiarity with applicable operating handbooks. It is the responsibility of the operator of this aircraft to familiarize themselves with all applicable handbooks and to obtain proper training.

AIRCRAFT LAYOUT & CONTROLS

COCKPIT AND BAGGAGE AREA

The cockpit layout of the Lightning LS-1 features side-by-side seating for two occupants with a baggage area behind the seats (see Figure S11).

Figure S11: Baggage Area

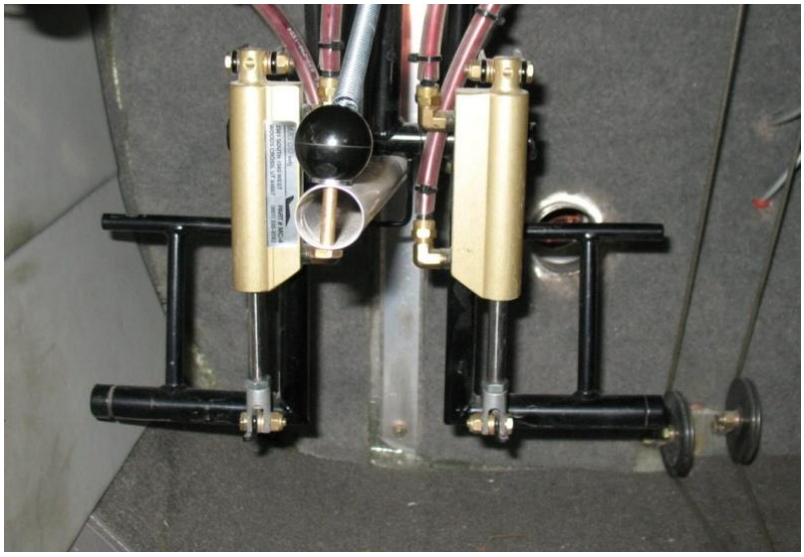


Figure S11-1: Rudder Pedals

PRIMARY FLIGHT CONTROLS

The Lightning LS-1 uses traditional rudder pedals for yaw control (see Figure S11-1). The pitch and roll controls are actuated using one of two control sticks, (see Item 1, Figure S11-2) with one in front of both pilot and passenger seats. Fore and aft movement of the control stick actuates the pitch control and left-right movement of the stick actuates the roll control.

The aircraft has a single engine throttle control located in the lower center of the instrument panel (see Figure S11-3).

Figure S11-2: Cockpit

Figure S11-3: Throttle

SECONDARY CONTROLS

The secondary controls are the elevator (pitch) trim, wing flap actuation, and braking controls. Pitch trim and wing flap switches are located above the engine controls in a GRT system (See Figure S11-4) or below the engine controls in a Dynon system.

The angle of the wing flaps is changed by a linear actuator mounted in the center console below and between the seats. The wing flap control rocker switch is located on the instrument panel, either above or below the engine controls (see Item 1, Figure S11-4). Pushing the bottom of the switch lowers the flaps and pushing the top raises the flaps. The elevator trim is actuated using the rocker trim switch (Item 2, Figure S11-4). Pushing the top of the

switch results in a nose-down condition and pushing the bottom results in a nose-up condition. Newer aircraft have the LED flap and trim position indicators omitted in favor of an electronic display on the primary EFIS.

Figure S11-4: Elevator Trim and Flap Switches with LED Indicators

The aircraft brakes are actuated using toe pedals as part of the left and right rudder pedals (see Item 1, Figure S11-5). The brakes are differential and are located on the rudder pedals. Pushing the left pedal actuates the left wheel brake and pushing the right

pedal actuates the right wheel brake. Releasing the pedal pressure returns the brake to the neutral (non-braking) position.

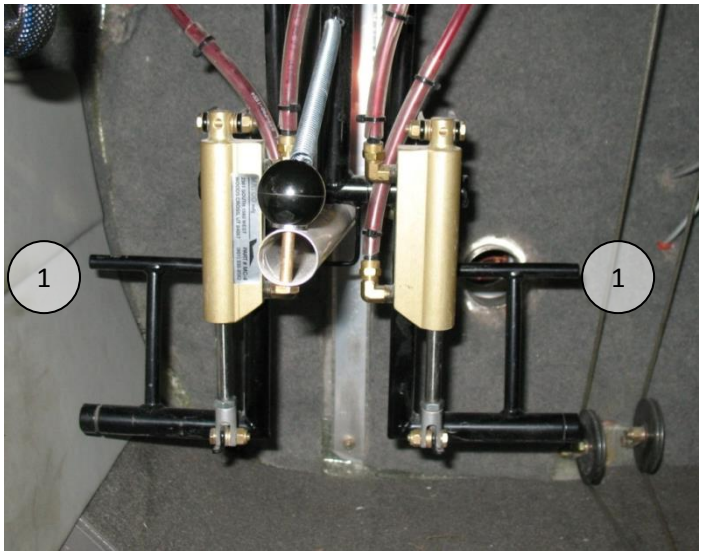


Figure S11-5: Brake Pedals

FUEL SYSTEM

The original LS-1 fuel system was comprised of an 11 gallon tank in each wing (total of 22 gallons). An optional 15 gallon tank (total of 30 gallons) has been made standard on all LS-1s manufactured after 2011.

FUEL SELECTOR

There is a fuel selector valve in the fuel system that controls the flow from the left and right wing tanks, respectively. In addition to the LEFT and RIGHT positions, the fuel selector also includes an OFF position. The selector is on the center console. (see Figure S11-8)

Figure S11-8: Fuel Selector Valve

FUEL SUMPS

The aircraft has two fuel sumps (one in each of the wing tanks) with quick-drain valves that must be checked during preflight operations. The wing sump quick-drain valves are located on the underside of the wing just outboard of the where the main landing gear legs enter the fuselage.

ENTRY & EGRESS, CANOPY OPERATION

The Lightning LS-1 Canopy is latched and unlatched by an exterior and an interior latch. The exterior canopy latch (see Figure S11-6) is located on the top of the aft edge of the canopy and the interior canopy latch (see Figure S11-7) is on the underside of the canopy at the same location.

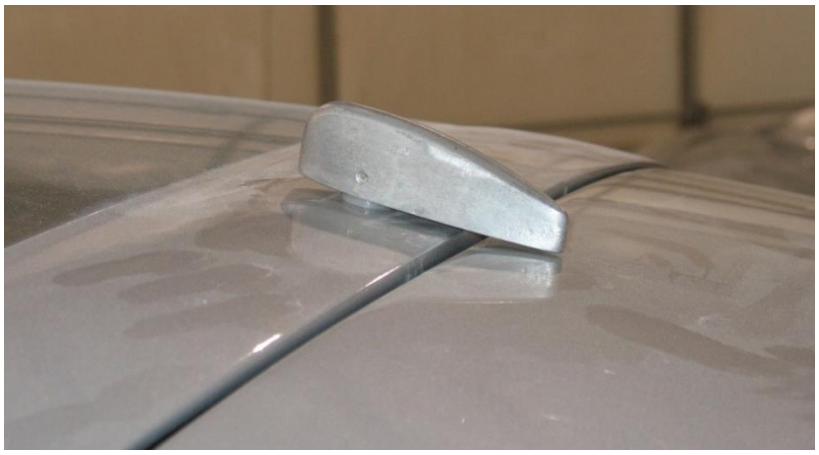


Figure S11-6: Exterior Canopy Latch

Figure S11-7: Interior Canopy Latch

COCKPIT ENTRY AND EGRESS

The height of the Lightning Sport canopy rail with respect to the ground and wing makes entry and egress very easy. The recommended approach for entry into the cockpit consists of stepping up on the wing and then stepping into the cockpit seat and sit down on the seat back. Then lower your legs into the cockpit floorboard area. The recommended egress method is opposite the entry method.

FLIGHT PERFORMANCE

SLOW FLIGHT

The aircraft is very stable and controllable in slow flight down to stall speeds. The control response during slow flight is typical of conventional configuration airplanes.

STALLS

In general, stalls in the LS-1 are relatively gentle, with a straight forward break if the airplane is flown with no yaw or skid/slip (ball is kept centered). There is a slight buffet felt about 2 to 4 knots before the stall. No flap stalls are much more nose high than are stalls with flaps.

SPINS

Intentional spins are prohibited in the LS-1. See Section 3 of this manual for spin recovery procedures.

TRANSITION TRAINING GUIDELINES

This section is presented to familiarize new Lightning pilots and their flight instructors with the basic operating knowledge and flight characteristics of the airplane. It is an outline of subject matter and flight exercises that have been proven to be useful during training in Lightning aircraft. Keep in mind that during transition training in any light-sport aircraft, pilots with previous flight experience are often used to flying heavier aircraft with different handling characteristics. No matter how much flight time a pilot has accumulated over the years, a comprehensive session of dual instruction with a flight instructor who is experienced in the Lightning LS-1 will go a long way toward a safe, pleasurable transition into light-sport aviation.

Insurance companies may require anywhere from one to five hours or more of flight training, including a specified number of landings, with a qualified CFI. New LS-1 pilots should check their insurance policy for specific transition training requirements before solo flight.

Lesson 1--Ground Aircraft Familiarization (2.0 Hours)

Section 1-- Cockpit and Instrumentation

I. Cockpit familiarization

A. Controls

- Throttle
- Carb heat control
- Cabin heat & ventilation control
- Choke control
- Control sticks
- Rudder pedals and adjusters
- Toe brakes
- Trim
- Flaps

B. Panel

- As required for equipment installed; EFIS system or round dials
- Engine Information System(EIS)
- Garmin radio, transponder and functions
- Switches & fuses or circuit breakers

II. Preflight Inspection

- Reference the checklist
- Any other items at instructor’s discretion

Section 2--Aircraft Systems

I. Airframe Systems

A. Flight Controls

- Ailerons
- Elevator
- Rudder
- Trim
- Flaps

B. Wheels & brakes

C. Fuel system

II. Engine Systems

- Carb heat
- Cabin heat
- Throttle & choke
- Fuel pump
- Oil fill & pump
- Oil over flow
- Caps & rotors
- Alternator

Section 3-- Normal operating procedures

- Before starting
- Engine starting
- Taxi
- Before takeoff checks

- □ Takeoff
- □ Climbs
- □ Cruise
- □ Descents
- □ Approach
- □ Landing
- □ Go-around and balked landings
- □ Shut down & securing

Section 4-- Performance charts and Weight and Balance

- □ Weight & balance
- □ Takeoff
- □ Cruise
- □ Landing

Comments_____

_____

_____

_____

Transitioning pilot: _____

Instructing pilot: _____

Date: _____

LESSON 2 -- Basic Flight Maneuvers (1.5 hours)

NOTE: Before beginning any flight training, the instructor pilot and transitioning pilot must be aware of each other's responsibilities in the cockpit. Have a "positive exchange of flight controls" technique in place and use it.

I. Basic Flight Maneuvers

- □ Climbs
- □ Decents
- □ Turns
- □ Combinations

II. Slow Flight

- □ Flaps up @ 70 kts IAS
- □ Flaps up @ 55 kts IAS
- □ Flaps down @ 65 kts IAS
- □ Flaps down @ 50 kts IAS
- □ Proper transition from slow flight to cruise (same as a go-around recovery)

CAUTION: Before practicing slow flight and stalls, become aware of the stall and spin recovery technique outlined in the POH for the LS-1. Stalls and spins are potentially hazardous in

any aircraft and must be treated accordingly.

III. Stalls

- □ Power on (partial power), flaps up-- to stall buffet only
- □ Power off, flaps up-- to buffet only
- □ Power off, flaps down --to buffet only
- □ Power on (partial power), flaps up-- full stall
- □ Power off, flaps up-- full stall
- □ Power off, flaps down-- full stall

Comments _____

_____

_____

_____

_____

_____

_____

_____

Transitioning pilot: _____

Instructing pilot: _____

Date: _____

Lesson 3-- Airport Operations (2.0 hours)

I. Takeoffs

- Normal takeoff
  a. Rudder only for directional control, no brake!
  b. Rotate 50-55 kts with smooth, slow pitch application.
  c. Pitch for the horizon (not an airspeed), let the aircraft accelerate.
  d. Climb out at 90 kts IAS once established.

- Short field takeoff
  a. Same as normal, but rotate 45-50 kts.
  b. Pitch for horizon and accelerate.
  c. Climb at 70 kts until clear of obstacle.
  d. At safe altitude, accelerate to 80 kts and retract flaps, then accelerate to 90 kts.

- Soft field takeoff
  a. Use elevator to keep weight off the nose wheel.
  b. Airspeeds same as short field

II. Approaches

NOTE: The first several trips around the pattern should be planned low approaches, with a go-around planned between 25 and 50 feet AGL, to allow the transitioning pilot to practice airspeed control and aircraft handling low to the ground. Pilots must have good stabilized approaches and consistent approach speeds on short final near 60 kts IAS before being allowed to land. This is in a no wind situation—approach speed at instructors discretion in windy conditions.

- Normal approach
  a. 80-90 kts IAS on downwind
  b. Abeam touchdown point, reduce power to near idle
  c. Carb heat out
  d. Slow to 80 kts IAS, add 10 degrees flaps
  e. 70-80 kts IAS on base, add 20 degrees flaps
  f. 60 kts on final
  g. Slow to 55-60 kts on short final, with 30 degrees flaps.

- Short field

a. Same as normal approach, but 50-55 kts on short final with full flaps.

- Soft field
  a. Same as short field approach.

III. Landings

- Short final
  a. Stabilized approach speed near 60 kts on short final
  b. Power to idle over the numbers
  c. **Full stall landing on the mains! Do not force the aircraft to land! Do not land in a 3-point stance!**
  d. Nose wheel should be held off as long as possible.
  e. Brake as required.

IV. Go-Around

- From anywhere in the pattern up to short final:
  a. Go-around procedure is same as slow-flight recovery.
  b. ***Fly the aircraft first,*** then slowly retract flaps and apply trim.
- From short final to runway:

a. Advance full throttle and fly the aircraft to a safe altitude.
b. Hold the nose on the horizon to establish a climb.
c. Carb heat off.
d. Retract flaps slowly until accelerated above 80 kts IAS.
e. Climb away normally at 90 kts IAS.

V. Bounced Landing

NOTE: Most bounced landings in the LS-1 are caused by excessive speed at touchdown. Avoid hard forward stick pushes as in a stall recovery, as porpoising will likely result. To recover from a bounce, hold the nose at a level attitude and try to re-flare or go-around.

a. If sufficient speed, reestablish the flare and land in a full stalled condition on the main wheels.
b. If slow or awkwardly banked or yawed, add full power, level the nose and wings, and climb away.
c. Clean up flaps and trim when at a safe altitude

in the same manner as described above for a short final go-around.

Comments:_____

_____

_____

_____

_____

Transitioning pilot: _____
Instructing pilot: _____
Date: _____

Lesson 4-- Emergency Operations (1.5 hours)

In all situations regarding emergency procedures, some of the most important things to remember are:

- Always fly the aircraft first.
- Do not try to save the aircraft. Having to trailer an aircraft out of field is much better than trying to make the airport and not succeeding.
- Your responsibility is to you and your passenger. When that responsibility is accounted for, then maybe you can save the plane.

I. Engine-out Procedure

- After takeoff, below 1000’ AGL:
  a. Establish best glide of 75 kts IAS
  b. Pick a field straight ahead or no more than 30 degrees each side of runway centerline.
  c. Approach and land.
  d. If sufficient time remains while gliding, try a restart.
- If above 1000’ AGL:
  a. Establish best glide airspeed of 75 kts IAS.
  b. A return to the airport can be attempted
  c. Practice 180 degree power-off approach and determine the altitude needed to turn the aircraft around and still have good altitude for an approach. Remember, you will need to turn more than 180 degrees to re-align with the runway you just left!
- All other situations at altitudes above 1000’ AGL and where sufficient time is available, attempted a re-start. **Refer to the POH for that procedure!**

II. Power off Gliding

- Best glide with flaps UP is 75 kts IAS.
- Best glide with flaps at 30 degrees is 64 kts IAS.
- Best loiter time (longest time in the air) is 50 kts IAS.
  a. Practice the above with your aircraft to get an idea of the minimum sink that can be achieved by each speed.

III. Key Position

Can be described as the position from which you can assure a power off approach and landing to the desired runway or field. Normally this is a point abeam the touch down area at about 1000'-1500' AGL.

- Practice power off approaches from this spot near the airport.
  a. Set up the aircraft between 1000'-1500' AGL abeam the touch down area.
  b. Reduce the throttle to idle and apply carb heat.
  c. Attempt to land at the airport on the runway within a given range.
  d. If must add power, you have under shot and

should try again.

e. If you over shoot the spot, you should try again.

f. Practice this until proficient at hitting the touchdown area using normal landing techniques.

- Once good at the above, set the aircraft up in different positions near the airport.
  a. Start at 5000’ AGL above the airport.
  b. Fly the aircraft in a glide to set up in the Key position.
  c. Repeat until proficient.

Comments:_____

_____

_____

_____

_____

_____

_____

Transitioning pilot: _____

Instructing pilot: _____

Date: _____

Lesson 5-- Review (Time as needed)

I. Review of topics at instructor's discretion.

Comments:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Transitioning pilot: _____

Instructing pilot: _____

Date: _____